AN INVESTIGATION INTO THE IMPLEMENTATION OF THE CONSTRUCTION (DESIGN AND MANAGEMENT) REGULATIONS IN THE CONSTRUCTION INDUSTRY

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Declaration

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ABSTRACT

The European Union (EU), in 1992, issued the Temporary or Mobile Construction Sites (TMCS) Directive, which requires EU members to introduce specific law to improve health and safety (H&S) performance outcomes by placing specific duties on key stakeholders. This Directive led to the introduction of the first Construction (Design and Management) (CDM) Regulations in the UK construction industry on 31 March 1995 and since their introduction, the overall performance of construction H&S has improved gradually. However, despite this positive outlook, there are still significant concerns surrounding the implementation of the CDM Regulations, a subject on which empirical research has been very scanty. It is against such a background that this study investigates the practical implementation of the CDM Regulations and extends current knowledge and understanding, and develops a framework for appropriate remedial action by industry.

The research method involved a thorough critical review of literature, semi-structured interviews, and two postal questionnaire surveys, using as research informants, practitioners with experience of the Designer, CDM Coordinator (CDM-C), and Principal Contractor (PC) roles under the CDM Regulations. Primary data were collected and analysed from in-depth interviews with six organisations purposively selected based on their construction design expertise and 122 questionnaires returned in total.

The finding regarding lack of collaborative working amongst duty holders is a significant outcome of this study; a requirement expressed explicitly within the CDM Regulations, yet questionable in terms of its implementation. Further, the study reveals a number of statistically significant correlations between the extent of discharge of duties and their perceived degree of importance. However, the strength of the majority of these correlations is weak. In particular, the evidence indicates that 50% of the duties of the CDM-C are misaligned in terms of extent of discharge and perceived degree of importance, whereas 25% of the PC duties are also misaligned. This signals a lack of understanding regarding the importance of duties, towards achieving improved H&S management. Surprisingly, a comparison between extent of discharge of duties and their perceived degree of difficulty reveals that all the duties of the PC are statistically significant, meaning that the perceived degree of difficulty does not impede their extent of discharge. While 90% of the CDM-C duties are also statistically significant, again the same interpretation applies. Further, a consensus reached by Designers supports the view that CDM-Cs provide insufficient input throughout the planning and construction phase, raising doubt as to whether the duty holder is fit for purpose. Overall, the results confirm that interdependent working of duty holders is still a challenge, demonstrated by the Designer duty to ensure appointment of the CDM-C (Regulation 18(1)), the CDM-C duty to ensure Designers comply with their duties (Regulation 20(2)(c)), and the PC duty to liaise with the CDM-C and Designer (Regulation 22(1)(b)). Three recurring themes emerge from the results, that is: (i) collaboration, (ii) accountability and compliance, and (iii) facilitation, which in turn inform the remedial action framework comprising 13 remedial actions and 8 change drivers.

Validation of the remedial action framework by 15 study participants reveals that, at least 10 remedial actions and 7 change drivers are considered likely to improve CDM implementation. The top three remedial actions are: (i) ensuring adequate arrangements for coordination of H&S measures; (ii) including provisions within the regulations specifying the stages for the appointment of duty holders; and (iii) amending the ACoP to provide guidance on determining what resources are adequate for a particular project. Whereas, the top three change drivers are: (i) management leadership; (ii) the proactive participation of duty holders; and (iii) training to equip duty holders with sufficient knowledge on provision of timely and adequate preconstruction information. Based on these outcomes, conclusions, recommendations, and further areas of research are drawn.

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LIST OF ACRONYMS AND ABBREVIATIONS

ACoP	Approved Code of Practice
AIA	American Institute of Architects
AIB	Asbestos Insulation Boards
AIR	Accident Incident Rate
APS	Association for Project Safety
ARB	Architects Registration Board
ARCTM	Accident Root Causes Tracing Model
CD	Consultation document
CDM	Construction (Design and Management) Regulations
CDM-C	Construction (Design and Management) Coordinator
CHSWR	Construction (Health, Safety and Welfare) Regulations
CIAT	Chartered Institute of Architectural Technologists
CIBSE	Chartered Institution of Building Services Engineers
CIOB	Chartered Institute of Building
CIRIA	Construction Industry Research and Information Association
CITB	Construction Industry Training Board
CPD	Continuous Professional Development
CPM	Critical Path Method
CSD	Chartered Society of Designers
CSR	Corporate Social Responsibility
EU	European Union
EC	European Commission
EASHW	European Agency for Safety and Health at Work
EEC	European Economic Community
EMR	Experience Modification Rate
EMM	Enforcement Management Model
EPS	Enforcement Policy Statement
FOD	Field Operations Directorate
FPWS	Faculty of Party Wall Surveyors
GDP	Gross Domestic Product
HSC	Health and Safety Commission
HSE	Health and Safety Executive
HSWA	Health and Safety at Work etc. Act 1974
ICE	Institution of Civil Engineers

ICS	Institution of Construction Safety
IfireE	Institution of Fire Engineers
IIRSM	International Institute of Risk and Safety Management
IMechE	Institution of Mechanical Engineers
IOSH	Institution of Occupational Safety and Health
LOLER	Lifting Operations and Lifting Equipment Regulations
MHSWR	Management of Health and Safety at Work Regulations
NAO	National Audit Office
NRAC	National Register for Access Consultants
ONS	Office of National Statistics
ORR	Office of Rail Regulation
PC	Principal Contractor
PCA	Principal Component Analysis
PD	Principal Designer
PPE	Personal Protective Equipment
PPIs/Ps	Project Performance Indicators/Parameters
PPPs	Project Performance Parameters
PRM	Project Risk Management
PtD	Prevention through Design
PUWER	Provision and Use of Work Equipment Regulations
RIBA	Royal Institute of British Architects
RICS	Royal Institution of Chartered Surveyors
RIDDOR	Reporting Injuries, Diseases and Dangerous Occurrences Regulations
RSA	Royal Society of Arts, Manufacturers and Commerce
RSPH	Royal Society for Public Health
SCM	Supply Chain Management
SEC	Specialist Engineering Contractors
SFARP	So Far As is Reasonably Practicable
SMS	Safety Management Systems
SPE	Safety Performance Evaluation
SPSS	Statistical Package for the Social Sciences
TMCS	Temporary or Mobile Construction Sites Directive

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DEDICATION

This thesis is dedicated to my mum *Ellen Joanna (EJ)* and late dad *James Dingayo (JD)*.

CHAPTER 1: INTRODUCTION AND RESEARCH BACKGROUND

1.0 INTRODUCTION

The poor performance of the construction industry is often associated with the occurrence of accidents and ill-health; a source of concern the world over (e.g. Wu *et al.*, 2010; Swuste *et al.*, 2012). In the UK construction industry, both fatal and non-fatal accidents are still commonplace. To tackle this challenge, measures such as legislation, research, and training remain paramount. This study is formulated around the underlying role of legislation, particularly in the area of Health and Safety (H&S).

A synopsis of the thesis is provided in this chapter. It highlights the importance of H&S in the construction industry (Section 1.1); draws particular attention to the Construction (Design and Management) Regulations (Section 1.2) and defines the problem (Section 1.3). The aim and objectives of the study are discussed in detail (Section 1.4), followed by an outline of the research design (Section 1.5). A summary of the main outcomes of the study and the organisation of the thesis are outlined in Sections 1.6 and 1.7 respectively.

1.1 HEALTH AND SAFETY (H&S) IN THE CONSTRUCTION INDUSTRY

Over the past three decades, H&S in the United Kingdom (UK) construction industry has been a source of considerable concern (e.g. Egan, 1998; Bomel Ltd, 2001; Lamont, 2005; Donaghy, 2009). This has been driven by a large and disproportionate incidence of accidents, injuries, and fatalities. H&S statistics obtained from the Health and Safety Executive (HSE) show this trend clearly. Despite a significant reduction in the number of accidents year on year in recent years, relative to other industries such as manufacturing and agriculture, construction still has the highest number of fatalities and is the second worst in terms of major non-fatal injuries in the UK as illustrated in Figures 1.1 and 1.2.

Between the period 2001/02 and 2005/06, the construction industry experienced a steady decrease in the number of fatalities. However, the periods that followed increasingly experienced fluctuations. As for major non-fatal injuries, the reduction was consistent, although the average between the period 2004/05 and 2010/11 was approximately 3896, clearly demonstrating that there is still considerable room for improvement. In the last ten years, there were over 693 fatalities (49 of which were members of the public) as a result of construction activities (HSE, 2012a).

In comparison to its European counterparts, statistics show that the UK has the lowest rate of fatal injuries to workers among the five leading industrial nations in Europe (i.e. Germany, France, Spain and Italy) (Eurogip, 2007). However, such observations should not encourage complacency, given the current statistics; rather must instil a greater sense of responsibility among construction stakeholders and society in general (Department of the Environment, Transport and the Regions, 2000). It is because of such evidence that H&S requires the much-needed attention to improve the overall outlook and performance of the UK construction industry.

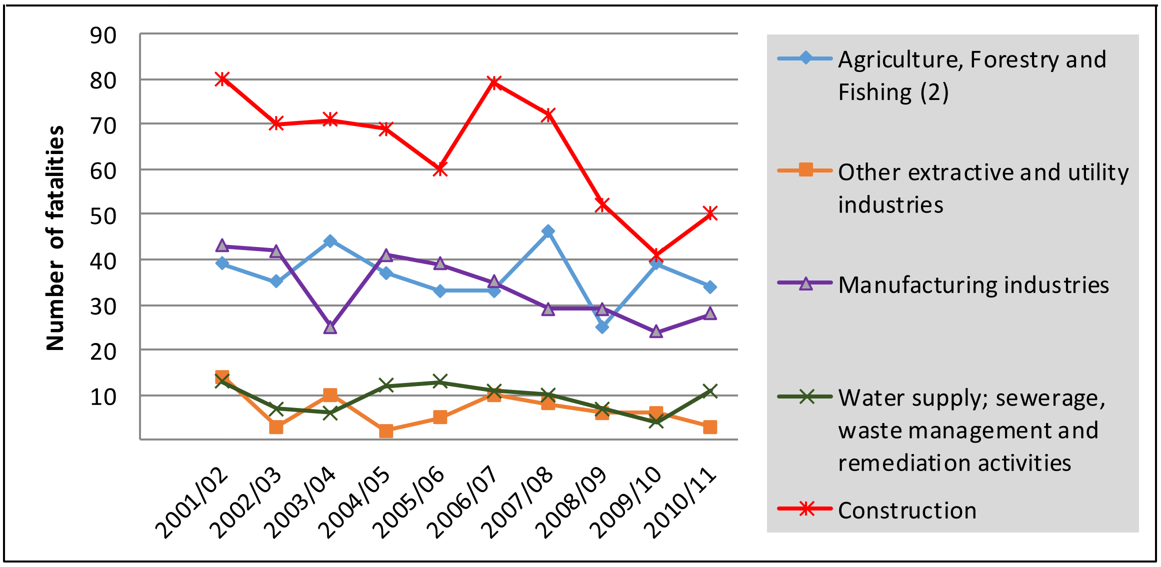

Figure 1.1: Number of fatalities in UK industries (HSE, 2012a)

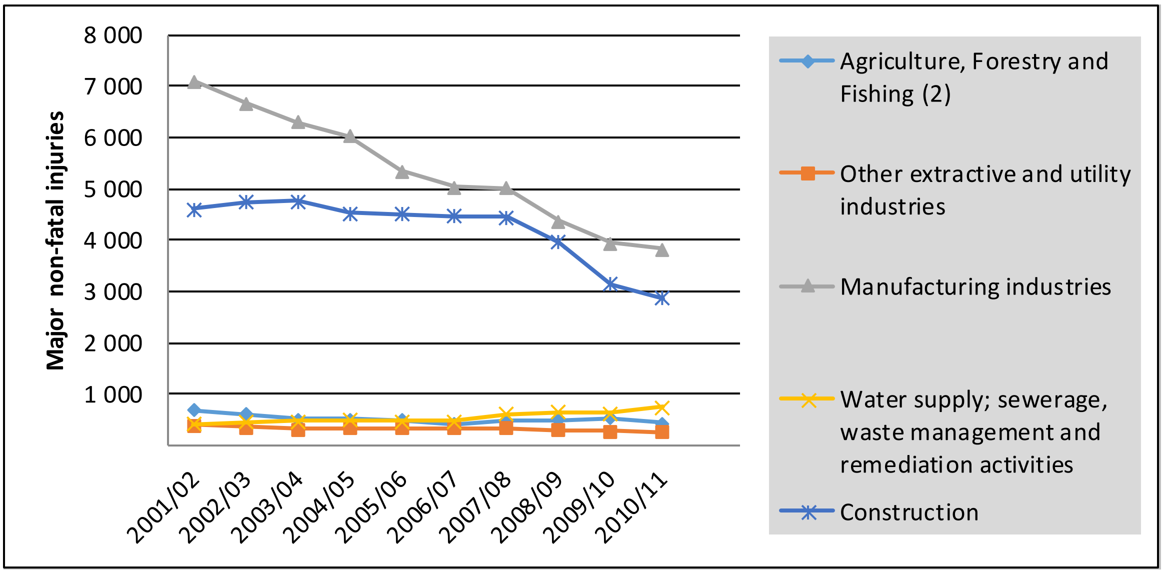

Figure 1.2: Major non-fatal injuries in UK industries (HSE, 2012a)

These recent statistics seem to suggest that H&S performance is an area that is still unpredictable given the consistent fluctuations in the number of fatalities reported for the period between 2004/05 and 2010/11 (see Tables 1.1 and 1.2). Besides the injuries and fatalities, there are also health concerns largely arising from occupationally acquired diseases such as musculoskeletal disorders, hearing loss, skin disease and other diseases associated with exposure to harmful substances (European Agency for Safety and Health at Work, 2004).

An inspection of employment figures reveals that the UK construction industry only employs approximately 7.3% of all persons in employment (see Table 1.2) and contributes over 6.8% of the overall growth domestic product (GDP) on a current turnover of £97 billion (ONS, 2013). Based on this observation, it can be argued that its contribution to accident occurrence and resulting injuries and fatalities which currently stands at approximately 29% (see Table 1.2), is completely disproportionate and as such presents a major challenge to the UK construction industry.

Table 1.1: Employee fatality trend: all industries

Year	Employees and Self-Employed Persons				
	Standard Industrial Classification (SIC)				
	Agriculture, Forestry and Fishing	*Other extractive and utility industries*	*Manufacturing industries*	*Construction*	*Service industries*
2000/01	46	8	50	105	83
2001/02	39	14	43	80	62
2002/03	35	3	42	70	70
2003/04	44	10	25	71	80
2004/05	37	2	41	69	62
2005/06	33	5	39	60	67
2006/07	33	10	35	79	79
2007/08	46	8	29	72	68
2008/09	25	6	29	52	60
2009/10	39	6	24	41	33
2010/11	34	3	28	50	49

Source: HSE (2012a)

Table 1.2: A comparative tabulation of the construction industry output (2010/11)

Category	Unit	Construction	Total (UK)	%
Employment	No.	2,150,000	29,414,000	7.3
Turnover	£	97 billion	1 trillion	6.2
Fatal injuries	No.	50	175	29
Major injuries (non-fatal)	No.	2867	26,053	11
Over 3-day injuries	No.	5,361	92,739	6

Source: ONS (2013)

It is therefore of no surprise that despite its economic importance as highlighted above and previously reported (see e.g NAO, 2004), the construction industry is widely regarded as dangerous, hazardous and of high-risk (e.g. Snashall, 1990; Mohamed, 2002; Edwards and Nicholas, 2002; Aires *et al*., 2010a; Antonio *et al*., 2013). Its image and reputation has consequently suffered resulting in challenges such as poor recruitment to the industry and skills shortages (Pearce, 2003; Bust *et al*., 2007). Consequences of construction accidents are widely considered as a hindrance to timely project completion (e.g. Ling *et al*., 2009; Brace *et al*., 2009). They are likely to: (a) cost the project owner/client more than the anticipated project cost (Gambatese and Hinze, 1999; Smallwood, 2004); (b) cause unnecessary delays/disruptions due to time lapses (Smallwood, 2004; Abudayyeh *et al*., 2006); (c) trigger increased insurance/workers compensation; and (d) reduce the profitability of any construction operation (Gambatese, 2000; Abudayyeh *et al*., 2006).

From a legal perspective, significant fines, compensation, liability suits and imprisonment for parties in breach of the law are possible undesirable outcomes (Abudayyeh *et al.*, 2006, p.168; Metherall, 2010). However, even more critical than the economic and legal perspective is the moral argument which was set out in the seminal report by Rita Donaghy appropriately titled "One death is too many" (Donaghy, 2009). Taken together, it can be concluded as suggested in a report prepared by Lord Young titled "Common sense, common safety" that the economic, legal and moral impacts, need to be seriously considered to improve H&S (Lord Young, 2010). What further exacerbates the concern of most stakeholders is the fact that many of these accidents and injuries can be prevented if appropriate action and decisions are taken at an opportune time (e.g. Anderson, 1992, 1994; Szymberski, 1997; Gibb *et al.*, 2006; Hare *et al.*, 2006).

Given these concerns expressed on numerous occasions, various initiatives targeting H&S improvement are common. For example, industry training (e.g. Construction Skills Certification Scheme) (Carpenter, 2006a) which often leads to behavioural change (e.g. Duff *et al.*, 1994; Langford *et al.*, 2000) is a measure that has been put in place. Other initiatives include strengthening of the legal framework (e.g. Anderson, 1994, 2010) and industry reward schemes (e.g. Shiplee *et al.*, 2011).

From a research perspective, Government sponsored seminal reports (e.g. Latham, 1994; Egan, 1998, 2002; Donaghy, 2009), industry-driven reports (SEC, 2010; ICE, 2011), and academic research (e.g. Gilbertson *et al.*, 2011) have sought to focus attention on the management of the construction process and its inherent risks to eliminate or reduce the incidence of accidents in construction.

The HSE (2009a) recognised the impact of key seminal reports which discuss drivers such as client leadership, team integration and skilled workforce (competency) towards H&S improvement. Integrating H&S in project planning and management is therefore crucial towards the overall success of projects, organisations and the construction industry as a whole (e.g. Hare, *et al*., 2006; Cameron and Hare, 2008). According to Smallwood (2004), the importance attached to H&S should be comparable with other project parameters such as cost, quality and schedule (time) (cf. Hare and Cameron, 2012). Recent initiatives, as highlighted in the preceding paragraph, have thus sought to bring about this parity (or even make H&S the predominant project performance parameter).

Whilst these initiatives tackle H&S from different perspectives (e.g. legal and behavioural) and contribute to H&S improvement in unique ways, it is widely accepted that laws have the most far-reaching impact (see e.g. Beck and Woolfson, 2000; Badri *et al*., 2012; Anderson, 2013). Given this insight, it is compelling to state that the legal regime offers an important platform towards H&S improvement in the construction industry (see e.g. Bomel Limited, 2007; Manu *et al*., 2011). The legal regime for H&S in the construction industry therefore requires careful scrutiny to ensure that it is fit for purpose and actually promotes good practice that leads to better H&S outcomes (see Anderson, 2013). Traditionally, it is well known that the contractor had the overall responsibility of H&S in the construction industry and faced safety issues on site during production (Cameron and Hare, 2008; Gambatese, 2000). Many of the early initiatives align with this focus on the activities of the contractor. For example, the early legal regime such as the Health and Safety at Work etc. Act 1974 (HSWA 1974), focuses predominantly on the contractor as an Employer and place specific obligations on them to protect employees.

Other secondary regulations that specifically target the contractor after introduction of the HSWA 1974 include among others (HSE, 2013a):

- the Control of Lead at Work Regulations 1980 (SI 1980/1248) – which stipulates that the employer is required to assess the work to establish the nature and degree of exposure to lead;
- the Notification of Accidents and Dangerous Occurrences Regulations 1980 (SI 1980/637) – which stipulates that the employer should keep records of accidents or certain types of accidents;
- the Control of Asbestos at Work Regulations 1987 (SI 1987/2115) – which stipulates that the employer should not to carry out any work which would expose employees to asbestos, unless prior assessment has been carried out;
- the Noise at Work Regulations 1989 (SI 1989/1790) – which stipulates that every employer shall reduce the risk of damage to the ears of employees;
- the Manual Handling Operations Regulations 1992 (SI 1992/2793) – which stipulates that employees should not be asked to carry out manual handling work and that the employers should take reasonable practicable action to safeguard employees from risk of injury;
- the Provision and Use of Work Equipment Regulations 1992 (SI 1992/2932) – commonly known as PUWER, impose a wide range of requirements for the provision and use of work equipment; and
- the Personal Protective Equipment at Work Regulations 1992 (SI 1992/2966) – which stipulates that personal protective equipment (PPE) should be supplied and used in the workplace particularly where there are risks to H&S that cannot be eliminated or managed in any other way. They also require proper assessment of PPE to ensure its suitability (i.e. issued with full instructions on

its safe use; storage and maintained properly; and used in an appropriate and correct manner by employees).

The limited effectiveness of such regulations focusing on the contractor's operations is widely reported (European Agency for Safety and Health at Work, 2004; HSE, 2009a). For example, a study conducted by Edwards (2003) titled "Accident Trends Involving Construction Plant: An Exploratory Analysis," reveals that despite enforcement of contractor focused regulations such as the Lifting Operations and Lifting Equipment Regulations (LOLER) 1998 and the Provision and Use of Work Equipment Regulations (PUWER) 1998, plant related accidents across the construction workforce remained largely unchanged.

A complete discussion on the H&S legal framework is provided under Chapter 3; however, it is clear that the focus of such early efforts was on downstream activities rather than upstream ones. As such, other project participants such as architects and engineers were never compelled to address production safety in construction design. In addition, Gambatese (2000) argues that architects and engineers have only focused on the safety of end users. Conversely, it is well-established knowledge that design decisions made during the early phases of a construction project can also influence safety (e.g. Szymberski, 1997). Even Martens (1998) argued that prevention of accidents should start at the source, which he identified as design.

As observed from Figure 1.3, upstream decision-making activities have an even greater influence on H&S than decisions during the construction phase. This argument is supported by Gambatese *et al.* (2008). They suggest that the planning and design phases provide the best opportunity to eliminate hazards before they appear on site, with the opportunity further decreasing as the project progresses. Further evidence is also provided by Behm (2005) having reviewed some 224 construction fatality reports and established that decisions made upstream (i.e. during the planning and design phase) significantly influenced construction worker safety. Behm (2005) concludes that design for safety decisions made upstream would have decreased 42% of the fatalities. The UK National Audit Office (NAO) also corroborates this view and suggests that design decisions account for 60% of fatalities (NAO, 2004).

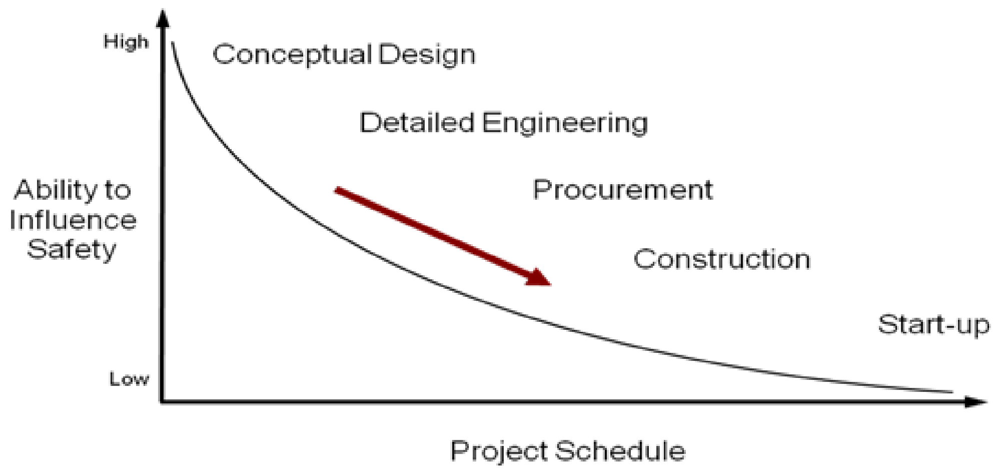

Figure 1.3: Time/Safety curve (Source: Szymberski, 1997)

It is because of such evidence that tremendous interest has been shown towards the Prevention through Design (PtD) concept which largely supports the views of Szymberski (1997) and theories related to construction design safety (e.g. Gambatese and Hinze, 1999; Gambatese *et al*., 2005; Toole and Gambatese, 2008). Moreover, because of its relevance to H&S (e.g. Gambatese *et al*., 2013), attempts have been made more recently to expand the safety responsibility to all project participants particularly those with early planning and design responsibility and to promote greater cooperation in the management of H&S risk. Even Gambatese (2000) was of the view that all parties involved during the execution of projects must share the safety commitment and responsibility; and particularly highlighted the importance of project owners taking up an active role.

As such, an attempt to widen the H&S responsibility to all project participants has been driven largely by the introduction of the Construction (Design and Management) Regulations ("the CDM Regulations") (Anderson, 1994) in the UK construction industry, which according to Gambatese and Hinze (1999) embraces the PtD concept and promotes its universal application. The CDM Regulations were introduced in the UK construction industry with the prime intention of reducing the number of deaths and accidents on construction sites and improvement of safety procedures (Anderson, 2003). Chapter 4 provides a thorough discussion outlining the main provisions within the CDM Regulations; however, the next section provides a brief summary of their application, to highlight some of the key problems and gaps in knowledge, which inform this study.

1.2 THE CONSTRUCTION (DESIGN AND MANAGEMENT) REGULATIONS

The primary H&S law in the UK is the HSWA 1974, introduced following a report prepared by Lord Robens (Lord Robens, 1972). It is under this Act that the regulations, (sometimes-referred to as *statutory instruments*) are formed according to Subsection 11(2)(d). The Act specifies the general obligations of employers concerning their employees and members of the public (HSE, 2009a). Besides the HSWA 1974, the European Council Directives also play a significant role in this regard. They are a legal Act of the European Union (EU), particularly aimed at the member states to introduce relevant legislation (see e.g. Eurogip, 2007; European Commission, 2011). Their aim is thus to ensure a common approach regarding implementation of various legislation throughout the EU (Joyston-Bechal and Grice, 2004). As a member state and in compliance with the European Communities Act of 1972, the UK Government introduces secondary legislation, an action known as transposition. As such, the most relevant H&S legislation in this regard is the CDM Regulations, complemented with a guidance code of practice (Anderson, 1994) and largely based on a self-regulatory framework.

Notably, since the introduction of the HSWA 1974 and the CDM Regulations, the overall outlook of H&S has gradually improved and gained the much-needed attention over the past four decades (e.g. Anderson, 1994; Hackitt, 2014). First introduced on 31 March 1995, the CDM Regulations 1994 (CDM 1994) transposed the Temporary or Mobile Construction Site (TMCS) Directive (EU 92/57/EEC) and placed specific duties on the Client, Designer, Planning Supervisor (PS), Principal Contractor (PC) and Contractor (Baxendale and Jones, 2000; Howarth, *et al.*, 2000; Ndekugri and Rycroft, 2009).

Of the five duty holders on which the CDM 1994 placed specific responsibilities, the PS and PC roles were completely new, since Clients, Designers and Contractors were traditionally prominent project stakeholders. As such, the CDM 1994 introduced two new project participants with a view of accurately meeting the conditions within the TMCS Directive. Clearly, the regulations broaden the H&S responsibility ethos as described in the TMCS Directive, thereby ensuring that key project stakeholders are accountable for their decisions and actions. However, numerous shortcomings experienced under the CDM 1994 regime, triggered their revision, thus replacing them with the CDM 2007 (Rabin, 2007). The main shortcomings under the CDM 1994 identified from literature are summarised in Table 1.3.

Table 1.3: A summary of the main shortcomings under the CDM 1994 regime

Description of the CDM 1994 shortcomings	**Source(s)**
Ineffectiveness of the Planning Supervisor role	The Consultancy Company (1997); Bomel Limited (2007)
Misunderstanding of duty holder responsibilities	Baxendale and Jones (2000); DETR (2000); Oloke *et al*. (2007)
Lack of awareness	Baxendale and Jones (2000); Oloke *et al*. (2007)
Missed opportunities to manage risks at the design stage	Baxendale and Jones (2000); Bomel (2007)
Mistiming of appointments	Baxendale and Jones (2000); Bomel (2007)
Lack of clarity of role(s)	Bomel Limited (2007); Beal (2007); Rabin (2007)
Excessive paperwork and Bureaucracy	The Consultancy Company (1997); Bomel Limited (2007)
Lack of compliance	Rabin (2007); Beal (2007)
Insufficient and inadequate H&S Plan and H&S File	Bomel Limited (2007); Beal (2007)

Description of the CDM 1994 shortcomings	Source(s)
Inappropriate implementation practices	Barnard (2007); Larsen and Whyte (2013)
Lack of integration of H&S management throughout the construction project lifecycle	DETR (2000); Cameron *et al.* (2004)
Ambiguity in what is considered adequate competency and resourcing	Lamont (2005); Carpenter (2006b)

As such, introduction of the CDM 2007 sought to: (a) clarify duty holder responsibilities, focusing on effective planning and risk management; (b) place priority on managing risks on site; (c) reduce paperwork; (d) encourage teamwork, and (e) highlight the importance of appointing competent personnel at the right time (HSE, 2009a).

1.3 THE PROBLEM

The preceding sections highlight the role of legislation in construction H&S, particularly during design, planning, and the construction phase. Its potential contribution towards reducing fatalities, injuries, and ill health resulting from construction activities is clearly established. The idea behind implementing legislation to promote safety particularly during design and planning is identifiable from the Factories Act of 1961 and subsequently the Robens report of 1972, which led to the introduction of the HSWA 1974 legislation.

Despite the potential contribution of legislation as argued above, current practices associated with CDM implementation raise doubt as to whether the sought after reduction in construction accidents and ill-health can be achieved (e.g. Dalby, 2009; SEC, 2010; Watson, 2010; ICE, 2011; Frontline Consultants, 2011). Whilst some consider the shortcomings to originate from the CDM Regulations themselves (e.g. Beal, 2007; Dalby, 2009), other leading authorities contend that the provisions within the regulations do not seem to be problematic (e.g. Löfstedt, 2011). Rather, the problem lies in the way they are implemented in practice (*ibid*). Löfstedt (2011) consequently recommends a complete overhaul of the Approved Code of Practice (ACoP) accompanying the regulations to improve their practical implementation.

Whichever perspective is assumed, what remains undisputed is the far-reaching impact of legislation, particularly the CDM Regulations in terms of H&S performance improvement (e.g. Martens, 1998; Gambatese, 2013; Cameron *et al.*, 2013), hence the motive for compliance. Clearly, further research into identifying practices associated with the discharge of duties and implementation challenges is crucial as a basis for future reform (cf. Larsen and Whyte, 2013). Undertaking such research reinforces any interventions towards improving the practical implementation of the CDM Regulations, thus creating a more effective regime for H&S management. Although duty holder responsibilities are specified explicitly within the regulations, their interpretation, application, discharge, and implication of practices largely remains unknown across the UK construction industry. Whilst there is some literature on practices with respect to CDM implementation (e.g. Scopes, 2009a,b; Pye Tait Consulting, 2010; Shiplee *et al.*, 2011; Webster, 2013), such reportage is patchy. At best, it only offers insight into isolated cases without indicating what the general trends and variances are in terms of the actual discharge of duties and compliance practices across the industry. Absence of complete evidence makes it difficult to assess whether the concerns expressed are because of ambiguities in the regulations or insufficient compliance and awareness (ICE, 2011).

The most common problems encountered under the CDM 2007 regime include:

(i) the lack of clarity or misinterpretation (Dalby, 2009; SEC, 2010; ICE, 2011);

(ii) inadequate guidance and Client leadership (Donaghy, 2009; Löfstedt, 2011);

(iii) complexity (Beal, 2007);

(iv) misjudged timing of appointments (Chan, 2009; SEC, 2010; Frontline Consultants, 2012a);

(v) conflicting industry practices (Carpenter, 2007; Tietz, 2007; Donaghy, 2009; Frontline Consultants, 2012a) and

(vi) lack of enforcement (Löfstedt, 2011; Frontline Consultants, 2012a).

It is also worth pointing out, that this research commenced before Government plans to revise the CDM 2007 and therefore considered timely and topical for future reforms even beyond CDM 2015. As such, the gaps in literature relating to current practices, inform the formulation of the aim and objectives of this study, set out in the next section.

1.4 AIM AND OBJECTIVES

To address the gaps in knowledge as identified in the preceding section, the aim of the study is to critically examine the practical implementation of the CDM Regulations, identify practices and deficiencies regarding the discharge of duties, and develop a framework for appropriate remedial action by industry.

Achievement of this aim requires pursuit of the following objectives:

1. critical review of literature pertaining to the state of H&S in the UK construction industry in order to establish its performance, improvement strategies and explore various accident causation theories;
2. examination of the H&S legal framework in the UK construction industry in order to identify the underlying principles behind the primary H&S legislation and explore theories that underpin its enforcement;
3. detailed analysis of the main provisions within the EU H&S Directives and the CDM Regulations in order to determine the degree of alignment and shortcomings associated with CDM implementation;
4. collection of primary data from key CDM stakeholders to examine the discharge of duties and identify practices and deficiencies associated with these obligations; and
5. development and validation of a remedial action framework.

1.5 RESEARCH DESIGN

This section highlights the steps taken to achieve the aim and objectives of the study. The research problem reveals that the extent of discharge of duties towards compliance with the CDM Regulations largely remains unknown. Moreover, the procurement process of construction projects and unique challenges experienced from one project to another inevitably exacerbates this problem. In seeking to address the fourth and fifth objectives of the study, undertaking fieldwork towards the collection of primary data to elicit views from practitioners was essential. Having identified the epistemological view within which the study fits (i.e. pragmatism), a mixed methods approach was considered appropriate. As such, the primary data collection involved conducting in-depth interviews with experienced Designers and undertaking two postal questionnaire surveys concurrently as advocated for by Oppenheim (1992). Indeed, the mixed method research design proved viable; an approach that has been reliably applied by other researchers (e.g. Gyi *et al.*, 1999; Manu *et al.*, 2014).

Besides the critical review of literature, informal consultations with industry practitioners were undertaken in order to understand the extent and nature of the problem. This involved attending industry CPDs, training on CDM Regulations and informal interviews with the workshop presenters and delegates. Undertaking such a strategy ensured that the gaps in knowledge were verified; thus informing the aim and objectives of the study. The research questions and research instruments were developed sequentially, after which pretesting of the instruments followed. From the pilot test, it was clear that the online survey method was not a suitable option given the poor responses. To increase the response rate, it was decided to discontinue with the online survey method and opt for the postal survey design utilising strategies explained by Oppenheim (1992). On the other hand, interview participants were identified through purposive and snowball sampling given the wide definition of Designers under the CDM Regulations. In total, 122 questionnaires were returned of which seven were incomplete and six design organisations took part in the in-depth interviews of the ten initially identified. After analysing the primary data, a framework for remedial action is developed. This framework referred to as the "Wider industry influence network for CDM implementation" (*Wiin-CDM*) is validated. Conclusions, recommendations, and further areas of research are drawn; also highlighting the limitations of the study (see Figure 1.4).

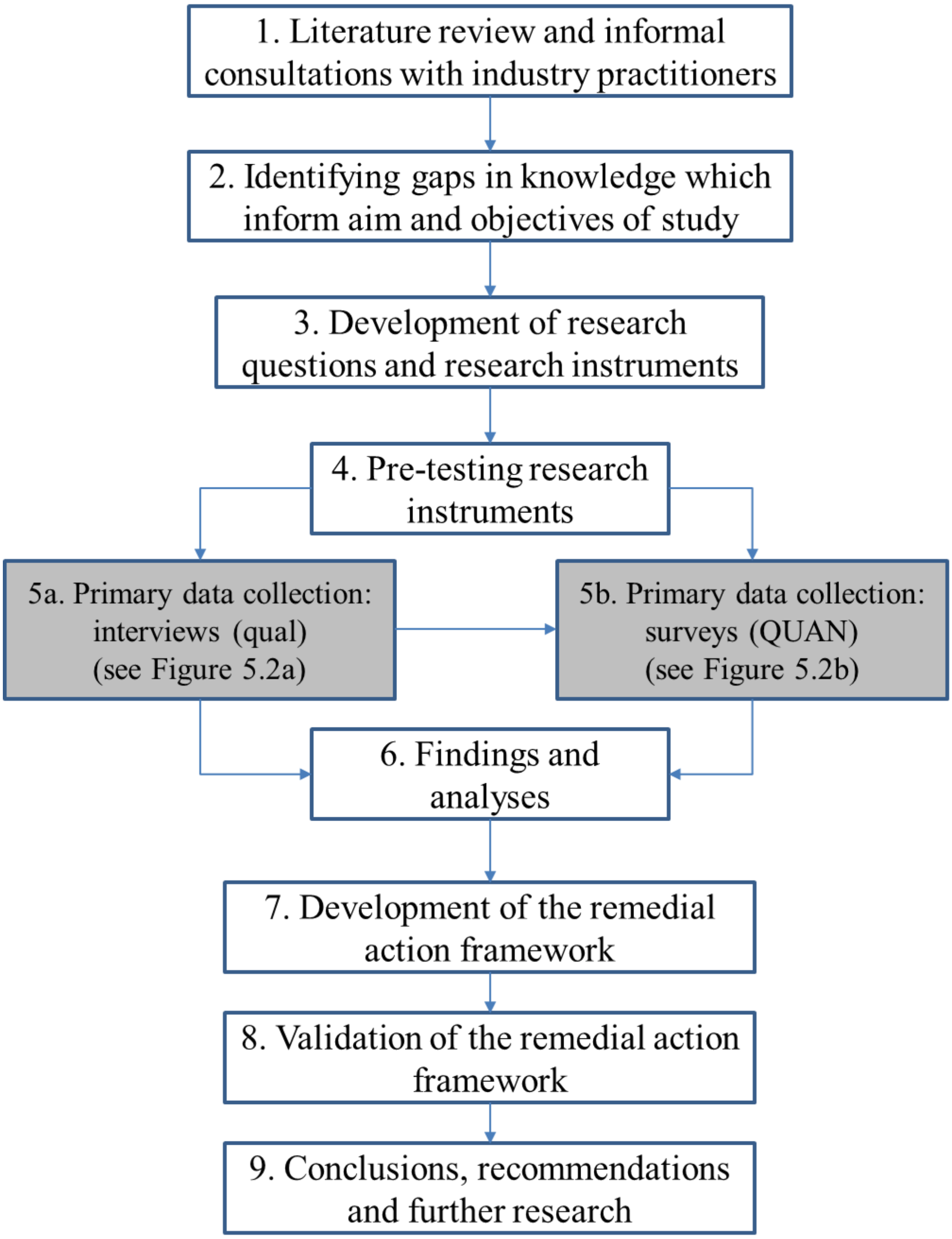

Figure 1.4: Research process

1.6 CONTRIBUTION TO KNOWLEDGE

Overall, it is conceivable to argue that the study extends the current understanding and knowledge pertaining to the implementation of the CDM Regulations. It shows that duties that require interdependent working are discharged less frequently than duties discharged independently, signalling collaborative challenges. Further, the evidence shows that there is a misalignment between the extent of discharge of duties and the perceived degree of importance, which signals failure to deploy resources accurately for the optimal discharge of duties, thus supporting the view that there is still considerable scope for CDM implementation improvement. Based on the developed remedial action framework (*Wiin-CDM*), it is both plausible and feasible to implement the majority of the remedial actions and change drivers towards improved CDM implementation.

1.6.1 Appointment stage of CDM duty holders

The results show that there is a tendency to appoint the CDM-C and PC during the late stages of design. Typically, the CDM-C is appointed during the technical design stage while the PC is appointed during the construction stage. Further, it is revealed that the appointment stage influences the subsequent discharge of duties, given the insignificant association with the earlier stages of appointment. Again, this signals that there is insufficient input received from the CDM-C and PC during the early stages of design. This failure regarding lack of early appointment further reduces the time required for CDM mobilisation.

1.6.2 Discharge of duties by CDM duty holders

The findings reveal that there are variations across the industry regarding the extent of discharge of duties and the perceived degree of importance and difficulty. It was observed that some duties are not always discharged as required by the law. Although these variances in the discharge of duties do not correspond to the perceived degree of difficulty of duties in terms of administrative work, organisational effort, and paperwork generation, it is clear that some duties are perceived to be far more difficult to discharge. It was generally observed that duties involving collaborative working are discharged less frequently. As for the perceived degree of importance, it was found that 50% of the duties of the CDM-C were misaligned, compared to 25% of duties of the PC. This failure to identify criticality of duties may have an impact on the overall H&S management given the need for accurate deployment of resources.

Furthermore, the evidence shows that the correlation between the extent of discharge of duties and the perceived degree of importance is typically weak, which is surprising given the need to prioritise resources. Similarly, the correlation between the extent of discharge of duties and the perceived degree of difficulty is largely weak, meaning that the perceived degree of difficulty does not impede the extent of discharge of duties. Designers on the other hand are aware of their duties and the issue of proportionality as a design strategy to deploy. However, differences emerge in the way Designers go about discharging their duties. Moreover, it was common to involve other experts when eliminating risks, thus delegating some of their responsibilities. Even where there is evidence of collaboration, it is clear that such practices are largely insufficient, particularly with the role of the CDM-C.

1.6.3 Resourcing required to perform the CDM duty holder role

The results reveal that not all duty holders are adequately resourced to perform their roles. For example, over 30% of CDM-Cs and PCs were inadequately resourced, which questions their ability to discharge duties sufficiently. As for dual appointments, the combination of CDM-C and Designer was the most common, whereas the PC and Main Contractor combination was also common, confirming that in most instances the Main Contractor is appointed as PC, indicative of an integrated project delivery route (e.g. Webster, 2013).

1.6.4 The proposed remedial action framework

To address challenges observed from the empirical evidence, a remedial action framework is developed, comprising 13 remedial actions and 8 change drivers. Validation of the *Wiin-CDM* and the subsequent analysis of the results reveal the order of priority to implement the remedial actions and change drivers. For example, ensuring adequate arrangements for coordination of H&S measures during planning and preparation for the construction phase is perceived as the most important remedial action, while management leadership is perceived as a critical change driver. This issue of management leadership resonates well with the suggestion by Price *et al.* (2004). In their study, Price *et al.* (2004) argue that empowerment is critical for change solutions given its potential to apportion responsibilities throughout the supply chain, thus empowering the workforce.

1.7 THESIS STRUCTURE AND OUTLINE

This thesis consists of 10 chapters as illustrated and explained in Figure 1.5. **Chapter 1** provides an overview of the entire thesis. It is split into eight sections, which describe the background of the study, the problem; its aim and objectives; the research design method(s), and a summary of the findings and conclusions. Generally, it provides a platform for the rest of the study.

Chapter 2 provides a thorough discussion on the state of H&S in the UK construction industry. Key concepts and theories emerge from this discussion, which provide insight into H&S performance improvement and interventions. It also highlights what previous research in this area has sought to accomplish.

Chapter 3 presents an overview on the UK H&S legal framework with particular focus on the construction industry. It provides information on previous and current laws regarding H&S, applicable to the construction industry and provides a critical discussion on early reportage that led to the introduction of primary and secondary H&S legislation, namely: HSWA 1974 and others (e.g. CDM Regulations) in a chronological manner.

To understand the implementation of secondary legislation, **Chapter 4** interrogates literature on the main provisions within the Framework Directive, TMCS Directive, and the CDM Regulations. After a thorough examination of these main provisions, it presents an outline of the implementation of the CDM Regulations highlighting the main shortcomings that partly inform this study and invite further research.

Chapter 5 is the research design chapter. It presents a justification of the adopted research design methods, based on a mixed methods approach informed by the pragmatism philosophical worldview.

Chapter 6 presents the analysis of empirical data from interviews. Focusing on the role of the Designer, it provides insights into practices associated with the discharge of their duties. Implications of such practices are then discussed.

Chapter 7 comprises of descriptive and inferential statistical analysis of the empirical data from the questionnaire survey(s). It presents findings particularly regarding the duties of the PC and CDM-C. Trends and variances associated with the discharge of duties in compliance with key obligations are assessed.

Chapter 8 provides a discussion on the developed remedial action framework to improve CDM implementation. The basis and subsequent development of the framework originates from the findings presented in Chapters 6 and 7 and the gaps identified in literature. A thorough guide is provided in terms of plausible steps for its application in practice. Further, a discussion on transposition of the TMCS Directive is incorporated in this chapter to assess the degree of alignment.

Chapter 9 provides a discussion on the validation of the developed framework. It explores its efficacy in terms of the commercial feasibility and practicality of implementing the remedial actions and change drivers. Further, implications of the remedial action framework are discussed in the context of industry practice and future reform.

Chapter 10 is the final chapter of the thesis. It provides an overview of the main outcomes of this study by highlighting the main conclusions drawn, articulates the recommendations to industry and other researchers, and provides an indication of areas that invite further research. Finally, the limitations of this study are discussed in detail.

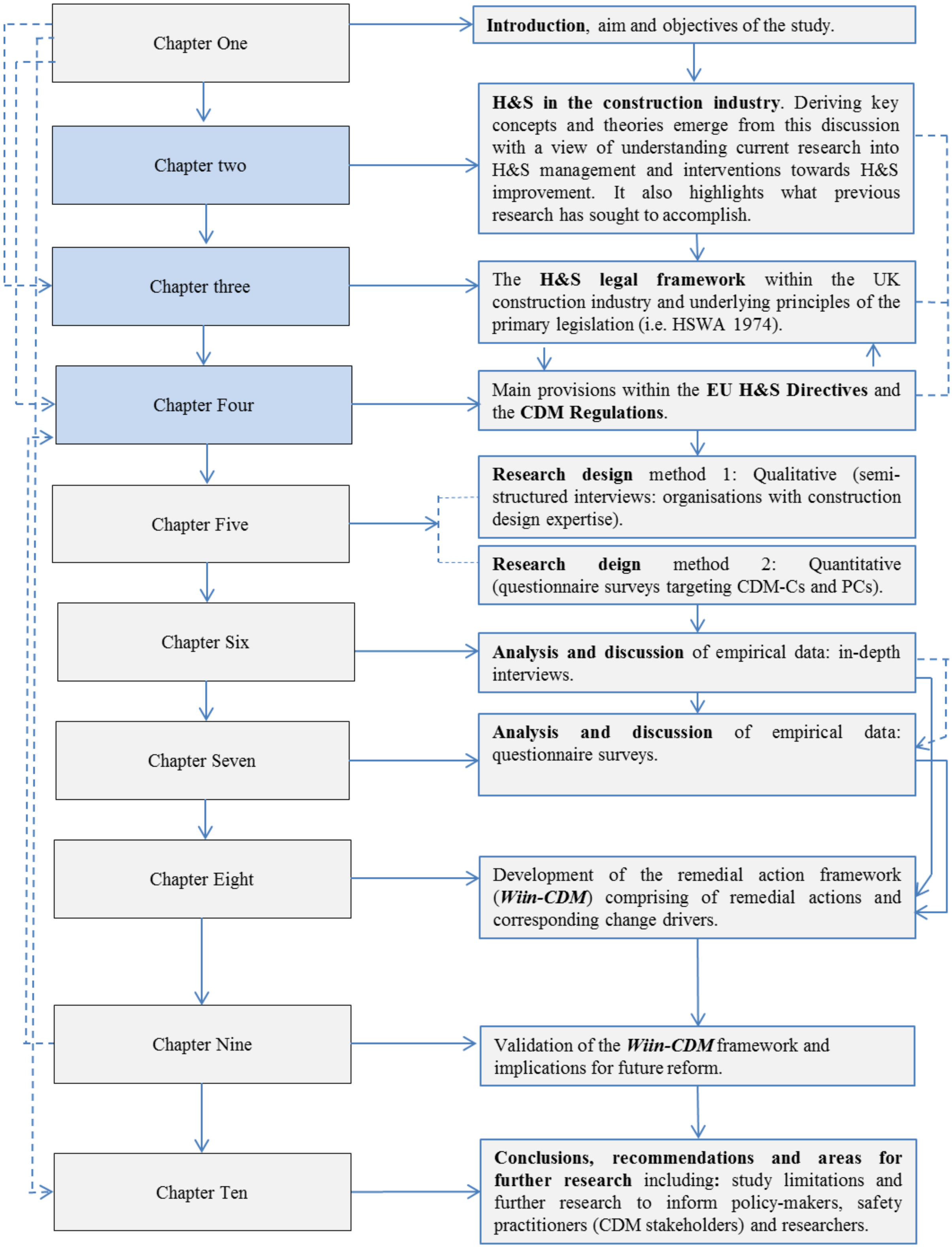

Figure 1.5: Thesis structure and sequence of chapters

1.8 CHAPTER SUMMARY

An overview of the performance of H&S in the UK construction industry is discussed briefly in this chapter. It also establishes the importance of H&S legislation, with particular focus on the CDM Regulations introduced in the UK construction industry. Despite their potential for reducing the occurrence of accidents and injuries resulting from construction activities, implementation of the CDM Regulations in practice has been a source of concern. The literature examined reveals that these concerns, such as bureaucracy, mistiming of appointments, increased paperwork, inadequate leadership, conflicting industry practices, and complexity, are largely informed by one-off and isolated cases, thus present limitations in terms of the general trends and variances across the industry at large.

This gap in knowledge triggers the need for further research into identifying practices associated with the discharge of duties. The purpose of this study is therefore to critically examine the practical implementation of the CDM Regulations, identify practices and deficiencies regarding the discharge of duties, and develop a framework for appropriate remedial action by industry.

CHAPTER 2: THE STATE OF HEALTH AND SAFETY IN THE UK CONSTRUCTION INDUSTRY

2.0 INTRODUCTION

To achieve the first objective of this study, a critical review of literature pertaining to the state of H&S in the UK construction industry is conducted in order to establish its performance, improvement strategies and explore various accident causation theories. Section 2.1 therefore provides an overview of Britain's H&S performance in the construction industry. Section 2.2 provides a discussion on H&S improvement strategies and explores the influence of the CDM Regulations. Section 2.3 discusses the causes of accidents in the construction industry and accident causation theories, while Section 2.4 summarises the chapter.

2.1 BRITAIN'S HEALTH AND SAFETY PERFORMANCE IN THE CONSTRUCTION INDUSTRY

Like most countries globally (see e.g. Kartam, 1997; Hoonakker *et al.*, 2005; Bust *et al.*, 2007; Hinze, 2008), Britain's construction industry suffers from fatal accidents, major injuries and ill-health because of construction activities (e.g. Bomel Ltd, 2001; Sherratt *et al.*, 2013). It is estimated that the construction industry globally, accounts for 60,000 fatal accidents per year on construction sites (ILO, 2005). In Britain, a critical review of construction accident statistics dating as far back as the 1980s onwards shows a downward trend (Anderson, 1992). For example, in the period between 1989/90, there were 165 fatalities in the UK construction industry compared to 46 in the recent past (2013/14) (Snashall, 1990; Anderson, 1992; Leigh, 2014). Notably, mechanisms regarding the reporting of accidents, injuries and dangerous occurrences have evolved and changed over the years.

The occurrence of accidents is indeed a major source of concern. Not only is it of concern to construction stakeholders, but also to the UK Government (e.g. DETR, 2000; Pearce, 2003; NAO, 2004; Swuste *et al*., 2010). Because of its potential to contribute significantly to the growth of the UK economy (see ONS, 2013), mitigating accidents and their root causes in the construction industry is a critical incentive. In this regard, it is of no surprise that the construction industry has significantly benefited from a regime such as the Health and Safety at Work etc. Act 1974 (HSWA) (e.g. Hackitt, 2014). However, there is often still concern associated with the number of accidents and injuries that still occur due to construction activities. The perception of the UK construction industry over many decades has been that of a dangerous one (e.g. Cameron *et al*., 2008; Sherratt *et al*., 2012). Although the rest of the UK construction industry is perceived better than Scotland (Cameron *et al*., 2008); their European counterparts (e.g. Eurogip, 2007; Aires *et al*., 2010a); and other industries within the UK (e.g. Edwards and Nicholas, 2002), the severity of accidents based on the available statistics cannot be ignored (Spanswick, 2006). It is for this reason that Government launched an initiative in March 1999, set out to consider revitalising H&S in the UK construction industry (Department of the Environment, Transport and the Regions (DETR), 2000; Spanswick, 2006). Having considered available statistics at the time and conducted exploratory meetings with industry stakeholders, the DETR concluded that there was significant scope to raise the standards of H&S in every sector across Great Britain.

Indeed, it is common practice to draw inferences based on accidents and ill-health statistics readily available from the HSE. For example, in their study, Cameron *et al.* (2008) compare accident rates between Scotland and the rest of Great Britain. Their study involved analysing records of fatal and major accidents in the construction industry between 1997 and 2002. The conclusions drawn by Cameron *et al.* (2008) indicate that there are more manual workers in Scottish construction than the rest of Great Britain. Of which the use of scaffolds and bricklayers was problematic, thereby increasing the rate of fatal and major construction accidents.

Available statistics over the past five years after the CDM 2007 obtained from the HSE show a gradual reduction in the number of fatal and non-fatal accidents. For example, Table 2.1, Figure 2.1, and Figure 2.2 show this trend, although arguably, the decrease observed year on year fluctuates.

Table 2.1: Fatal and non-fatal injuries rates per 100 000 - construction workers

Year	Deaths	Major injuries	Over 3-days injuries
2007/08	3.3	231.5	467.9
2008/09	1.9	200.1	413.6
2009/10	2.0	180.9	397.2
2010/11	2.3	173.9	362.7
2011/12	2.3	171.8	415.4
2012/13	1.94	157.9	n/a

Source: HSE (2013b)

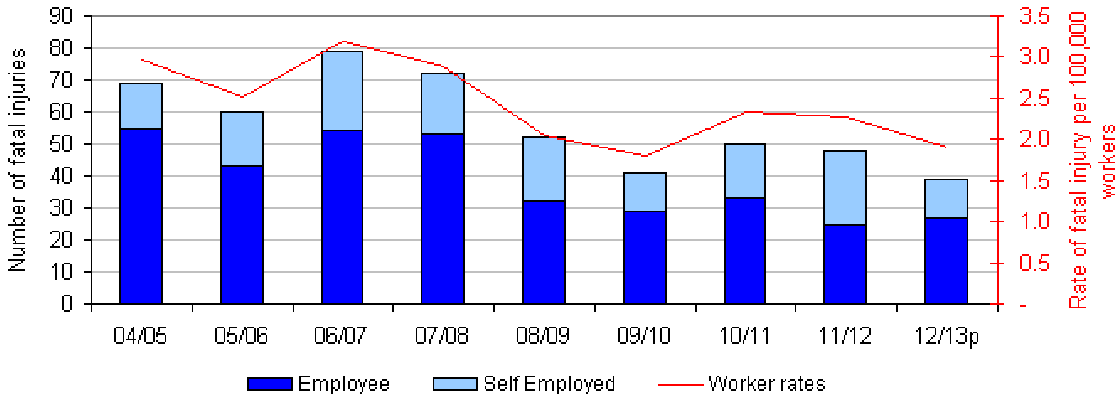

Figure 2.1: Number of fatalities per 100 000 workers (Source: HSE, 2013b)

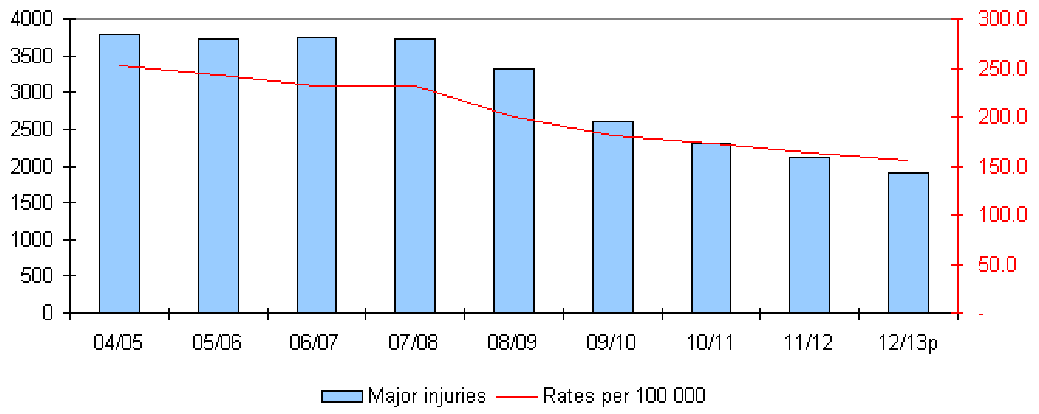

Figure 2.2: Number of major injuries per 100 000 workers (Source: HSE, 2013b)

A closer examination of the kinds of fatalities in the UK construction industry shows that, falls are accountable for over half of the fatalities (i.e. 59%) and being struck by a moving object accounts for 3% of the fatal injuries (see Table 2.2). Similarly, in all industries, falls account for the highest proportion of fatalities. As for major injuries, 88% were because of handling, while being struck by a moving or falling object accounted for the smallest proportion (i.e. 15%). Cumulatively, slips, trips, and falls on level caused 40% of major injuries in all industries. Falls account for 15% of the major injuries, while being struck by a moving/falling object and handling each account for 11% (see Table 2.3). From these statistics, it is reasonable to conclude that falls from height still account for most fatalities in the construction industry, while handling accounts for major injuries.

Table 2.2: Proportion of fatalities by the kind of injury

	Proportion of fatalities in		
	Construction	Construction	All industries
Injury kind	**2012/13**	**2008/09 – 2012/13**	
Falls	59%	49%	25%
Being struck by a moving/falling object	3%	10%	16%
A collapse (overturn)	5%	11%	10%
Being hit by a moving vehicle	10%	10%	15%
Electricity	5%	7%	4%

Source: HSE (2013b)

Table 2.3: Proportion of major injuries by the kind of injury

	Proportion of major injuries in		
	Construction	**Construction**	**All industries**
Injury kind	**2012/13**	**2007/08 – 2011/12**	**2008/09-2012/13**
Falls	28%	28%	15%
Slips, trips and falls on level	28%	26%	40%
Being struck by a moving/falling object	15%	15%	11%
Handling	88%	13%	11%

Source: HSE (2013b)

2.2 HEALTH AND SAFETY IMPROVEMENT STRATEGIES

Workplace accidents causing death, injuries and ill health are a common occurrence in the UK construction industry (e.g. Bomel Limited, 2003; Cameron *et al.*, 2008). Although, the UK construction industry performs far much better than its European counterparts (e.g. Wolf and Brick, 1996; Gibb *et al.*, 2006; Aires *et al.*, 2010a; Aires *et al.*, 2010b), even one fatal accident is unacceptable, given the impact on society as a whole (e.g. Lamont, 2005; Donaghy, 2009). It is still a contentious issue that requires H&S performance improvement (e.g. Sertyesilisik *et al.*, 2010). Given this background, tremendous progress is being made towards improving the overall outlook of H&S in the UK construction industry. These measures, deliberately put in place to mitigate the occurrence of accidents on construction sites, have received significant attention over the recent past (e.g. Martin, 2004; Bosher *et al.*, 2007; Butcher and Sheehan, 2010), as demonstrated in the following sections.

2.2.1 Modification of behaviour towards improved workplace culture

Duff *et al.* (1994) advocate for modification of behaviour as a viable strategy towards improved safety performance in the construction industry. They explain that those concerned with construction operations need to change their behaviour of how they view their workplace. Having tested mechanisms such as goal setting and feedback methods on six construction sites in the Northwest of England, at three different time intervals, a clear indication of considerable improvement in safety performance is revealed (Duff *et al*., 1994).

Even Lingard and Rowlinson (1997) who replicated the study in the context of Hong Kong's construction industry found that the behaviour based safety techniques were highly effective regarding site housekeeping. Whereas access to heights was only significant on two sites of the seven public housing construction sites examined. Further, Langford *et al.* (2000) studied the attitudes of construction workers towards safe behaviour whilst working on construction sites. They examined some 126 responses and found five major factors that influence the attitudes of workers—that is, (a) organisational policy, (b) supervision and equipment management, (c) industry norms, (d) risk taking, and (e) management behaviour. Other studies have even argued that modification of behaviour invites change, and requires putting in place complementing initiatives such as training (e.g. Cohen, 2002; Ng *et al*., 2005).

2.2.2 Prevention through Design (PtD)

Increasingly, over the last decade or so, there has been growing interest to integrate design, project planning and management of projects (see e.g. Dainty *et al*., 2001; Edum-Fotwe *et al*., 2002; Hare *et al*., 2006; Cameron and Hare, 2008; Reyck, 2010). In this regard, PtD is a culmination of such efforts. This concept has risen to prominence and requires those with design responsibilities to take a proactive approach towards designing for worker safety (Gambatese *et al*., 1997).

Toole and Gambatese (2008) define the process as one where "[…] design professionals (namely, architects and engineers) explicitly consider construction worker safety while designing a facility." Gambatese (2000) stresses that when Designers and Engineers are cognizant of safety decisions; safety performance is likely to improve, resulting in reduced accidents and injuries. It is no surprise therefore that Gambatese *et al.* (2005) and Gambatese *et al.* (2008) advocate for the implementation of PtD as a viable intervention strategy in practice to improve H&S. The seminal work by Szymberski (1997) expressed this approach in the following manner:

> *when safety is planned from the outset, the potential for accidents is drastically reduced…the way to have excellent safe working conditions for the construction workers is to make their safety one of the projects highest priorities.*

Notably, even though the design practitioner is central in implementing PtD, the input of other project stakeholders is also critical (e.g. Sumner and Farrell, 2003; Blismas *et al.*, 2004). As such, a holistic team oriented approach relying on the concerted efforts of all project participants is beneficial to the overall improvement of H&S (e.g. Gambatese *et al.*, 2008; Lingard and Wakefield, 2013). For example, Atkinson and Westall (2010) observed that integrated working of key stakeholders is likely to trigger safety performance improvement action. Their study examined the accident performance of 55 large construction projects in the UK. The conclusions drawn suggest a strong correlation between integrated designer/contractor working and proactive safety, which resonates with the CDM Regulations ethos of shared responsibility.

Moreover, given that the construction industry is widely considered as fragmented (e.g. Larsen and Whyte, 2013), it is reasonable to suggest that the CDM Regulations are well placed to bring stakeholders closer together in an integrated way. As such, providing a platform and mechanism for considering project safety from the design stage (upstream) to actual construction and maintenance (downstream) proactively (e.g. Szymberski, 1997). Again, as argued previously and acknowledged by many authorities (e.g. Gambatese, 2000; Gambatese *et al.*, 2005; Gambatese *et al.*, 2008), construction H&S intervention should preferably start from the outset of the design stage (upstream), so as to apply design decisions that increasingly lead to eliminating or reducing hazards. Szymberski (1997) points out that increasingly, a significant opportunity to influence safety during preconstruction is reduced as the project progresses. Similarly, a finding by Larsen and Whyte (2013) based on a case study indicated that a late change in design, significantly proved challenging and increased the difficulty to safely plan construction activities.

Toole (2005) recommends increasing the Engineer's role in construction safety by reviewing designs; creating design documentation; assisting the owner in procuring construction; reviewing submissions and inspecting the work in progress, which largely reflects the Designer's obligations under the CDM Regulations. Indeed, the Designer's role is significantly important when considering safety decisions as demonstrated on several occasions (e.g. Maitra, 1999; Carpenter, 2006a; Webster, 2013).

An example where the PtD concept has been implemented in an integrated design approach to benefit H&S, was demonstrated in the construction of the Velodrome venue for the London 2012 Olympic and Paralympic games (see Arnold *et al.*, 2011). The initial roof design concept was replaced based on its restrictive nature on site and the amount of construction work at height, creating unsafe work practices (Shiplee *et al.*, 2011). Having consulted the CDM-C and other team members, the design team reviewed their design decisions and came up with an innovative roof design; thus reducing the H&S risks (Shiplee *et al.*, 2011).

To apply such innovation, various tools have been developed which enhance this integrated design approach. One such tool that has grown to prominence because of its rapid development is Building Information Modelling (BIM). BIM is known for its potential to integrate various stakeholders (i.e. project teams) towards accomplishing a common goal. Sebastian (2011) defined BIM as "ICT frameworks and tools that can support the integrated collaboration based on lifecycle design approach". It is because of this project design and planning integration ethos that BIM presents an opportunity to improve safety performance (e.g. Benjaoran and Bhokha, 2010; Zhou *et al.*, 2011). It offers change in behaviour, process and legal frameworks among others (Joyce and Houghton, 2014; Olatunji, 2014). For example, Benjaoran and Bhokha (2010) developed an integrated system for safety and construction management using a 4D CAD model. The developed system utilised stored information to detect hazards such as working from heights and by taking these steps, provided alternative safety measures, thus alleviating safety concerns. The results from the prototype showed that safety awareness and collaboration is enhanced and triggered design revisions (Benjaoran and Bhokha, 2010).

Lingard *et al.* (2011) and Lingard *et al.* (2012) on the other hand contend that there may be real practical problems associated with BIM because of the complex and sometimes provisional nature of design. Despite this view, its potential to bring various parties together remains undisputed (e.g. Sebastian, 2011; Bennett and Mahdjoubi, 2013; Harty and Laing, 2013; Hayne *et al*, 2014). Other studies even go as far as suggesting that BIM has the potential to provide benefits throughout the project lifecycle (e.g. Eadie *et al.*, 2013).

It is therefore of no surprise that the UK Government has endorsed BIM as a viable project procurement tool (Sweet, 2011; BIS, 2013a), because of its ability to produce as built drawings (Eadie *et al.*, 2013), enhance safety awareness and collaboration as demonstrated above. Additionally, in the context of the UK construction industry, it is reasonable to argue that BIM has the potential to improve implementation of the CDM Regulations (e.g. Bennett and Mahdjoubi, 2013; Joyce and Houghton, 2014). In a legal note produced for the

Institution of Civil Engineers' advisory panel on legal affairs, Joyce and Houghton (2014) describe BIM as a process that captures project information in digital form and if implemented in a proper manner, yields tangible benefits such as improved project H&S *inter alia*. They even envisaged that the

> *...beneficial application of BIM to administration of the CDM regulations 2007 will still be relevant when the new CDM regulations are made in 2015* […].

The aforementioned sheds light on the potential role of BIM towards H&S improvement and reveals the potential interplay between BIM and the CDM Regulations. This is consistent with the recommendations of a study that investigated CDM Regulations 1994 practices. From their evidence, Mulholland *et al.* (2005) advocate for the use of electronic storage systems to reduce paperwork. Indeed, this confirms the plausibility of applying BIM as a tool to support improved CDM implementation and overall H&S outcomes. Most importantly, this section demonstrates the importance of the PtD concept as a mechanism in support of H&S improvement, and reinforces the importance of the Designer's role.

2.2.3 Stakeholder involvement

In terms of grappling with the H&S issues, the direction of the UK construction industry as a whole agrees with the Government's approach, although this is not quite the same with academic initiatives. This was the conclusion reached by Rawlinson and Farrell (2010) having examined the content of 20 large UK contractor websites, particularly on the subject of construction site H&S management. Although the study was limited because of the use of a desk study method, the findings suggest that the H&S responsibility by way of Corporate Social Responsibility (CSR) is well embraced. Notably though, extending this view in the context of the CDM Regulations proved limited, given that it only represents to some degree two duty holders (i.e. the PC and Contractor) leaving out the Client, Designer and CDM-C. Despite this view, their conclusion corroborates earlier findings by Sawacha, *et al.* (1999) which suggest that variables related to organisational policy had the highest impact on safety performance (cf. Molenaar *et al.*, 2009). It is against such a background that it is reasonable to argue that the industry is fully aware of its H&S responsibility. Besides there are undesirable consequences because of falling short, beyond moral and financial aspects, and the unhealthy image of the industry (e.g. Latham, 1994; Gyi *et al.*, 1999; Ndekugri, 2013). Ng *et al.* (2005) explored literature relating to safety performance and found six main factors and thirteen sub factors at the organisational level as illustrated by Figure 2.3.

In terms of prioritizing the main factors, their results based on a survey targeting three categories of construction stakeholders show that administrative and management commitment was ranked first, H&S training ranked second, and legislation, codes and standards ranked third. Other factors ranked fourth, fifth and sixth include selection and control of subcontractors, safety review and accident record. As for ranking the sub factors in terms of their importance towards safety performance evaluation (SPE), the two most important factors were: (i) implementation of safety management systems in accordance with legislation and (ii) compliance with occupational safety and health legislation, codes and standards (Ng *et al.*, 2005). Similarly, in the context of the CDM Regulations, it is reasonable to argue that the roles of stakeholders towards safety improvement are of profound importance. To achieve this, others researchers have recommended applying ICT tools (e.g. Oloke *et al.*, 2005; Yu *et al.*, 2007) and integrating H&S training both at university level or within industry at various levels (e.g. see Shabha and Rudge, 1997; Oloke *et al.*, 2007; Hare and Cameron, 2011; Care *et al.*, 2012). Taken together, it can be summed up that indeed stakeholders have a role to play towards improved H&S performance. Some contraction organisations even go as far as implementing a ‘Zero Harm’ or ‘Zero Accidents’ policy (e.g. Sherratt, 2014).

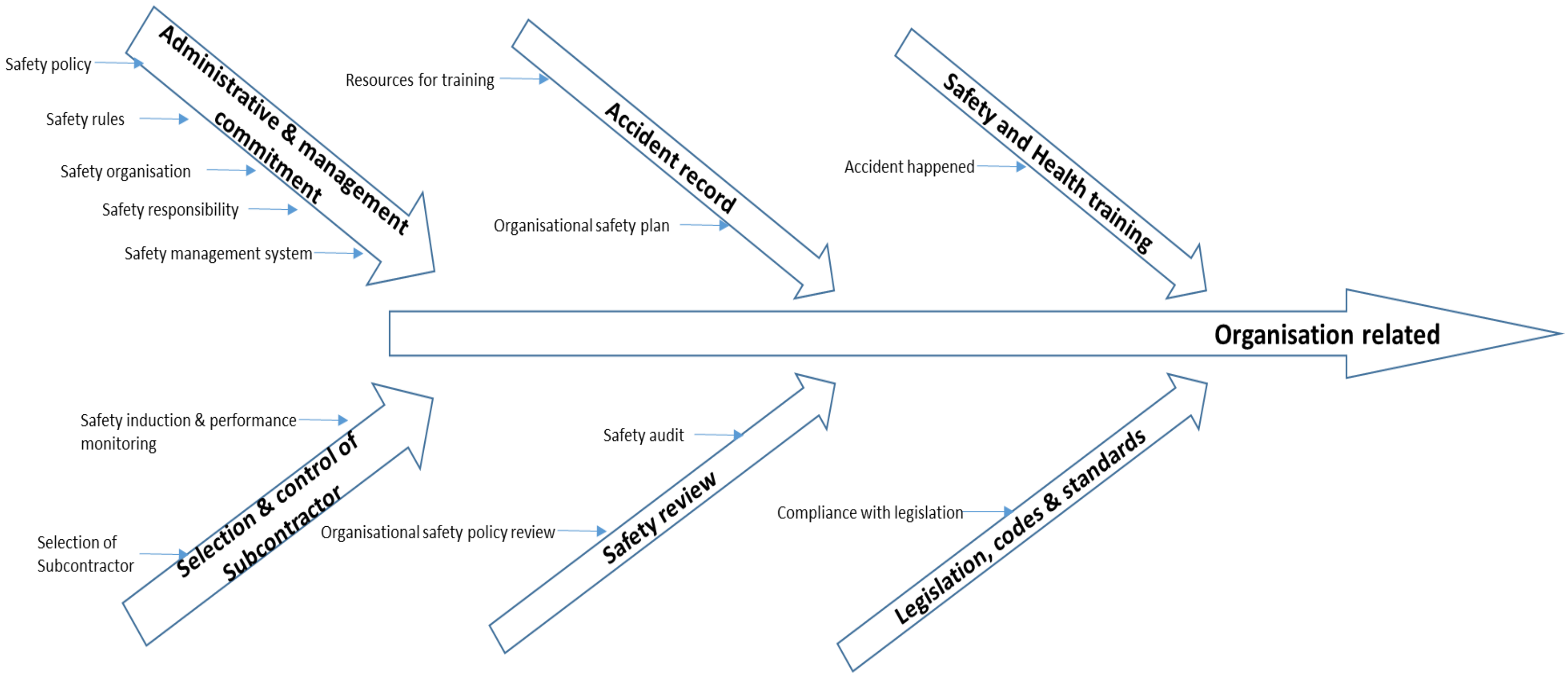

Figure 2.3: Safety factors at the organisation level (Source: Ng *et al.*, 2005)

2.2.4 Seminal reports in support of H&S performance improvement

The improvement of H&S has been widely publicised within seminal reports. These reports date as far back as two decades ago. For example, the Latham report (Latham, 1994), commissioned jointly by Government and the construction industry, comment that the CDM regulations present an opportunity for H&S improvement by placing specific duties on key project stakeholders. Similarly, the Egan report (Egan, 1998), recommends “commitment to people” as one of the drivers of change by caring for their H&S.

A follow-up report post Egan 1998, recommends the use of competent integrated teams to improve the overall outlook of the UK construction industry’s H&S performance (Egan, 2002). Additionally, a review by Wolstenholme (2009) concurs with this view and also recommends that there is still scope for improvement, given that what was set out in the Egan report was underachieved.

Furthermore, beyond accidents either resulting from construction equipment (e.g. Gibb *et al.*, 2005) or indeed individual cases, a holistic study undertaken by Bomel Limited (Bomel Limited, 2004), “captures the wider human and organisational factors affecting sites and the industry in general”. This was accomplished by undertaking various workshops and analysing the RIDDOR data. The workshops and post-event analysis culminated into establishing critical factors and the critical path on an ‘influence network’. It comprised of 37 factors presented at four levels. The levels of influence included the direct level influence, organisational level influence, policy level influence, and environmental level influence. The direct level influences are defined as those likely to influence directly the occurrence of an accident (or proximal factors). The organisational influences are considered to influence the direct level and reflected the procedures, culture, and behaviour of an organisation. At the policy level, decisions related to organisation standards and structures are reflected, while the environmental influences (or distal factors) capture the wider aspects such as regulatory regimes (Bomel Limited, 2004).

In the same report, Bomel Limited (2004) advocates for its application to other research and suggests that it is open to further refinement. For example, Webster and Lloyd-Kendall (2012) included two other factors to the model. At the environmental level, industry influence was a new factor and at the organisational level, consideration of welfare conditions was included. Frontline Consultants (2012b) and Webster (2013) replicated this model in subsequent research. In the context of CDM implementation, the model is used to assess the impact of CDM on H&S outcomes. As such, the influence network demonstrates how improved H&S outcomes can be attained systematically originating from the regulatory influence (see Figure 2.4).

More recently, reports such as Donaghy (2009) and Löfstedt (2011) also highlight the importance of H&S regulations. For example, Donaghy suggests extending the building regulations to capture H&S processes and review Higher Education curricula to capture H&S awareness and risk management issues among others. A detailed discussion of these two reports is in the subsequent paragraphs.

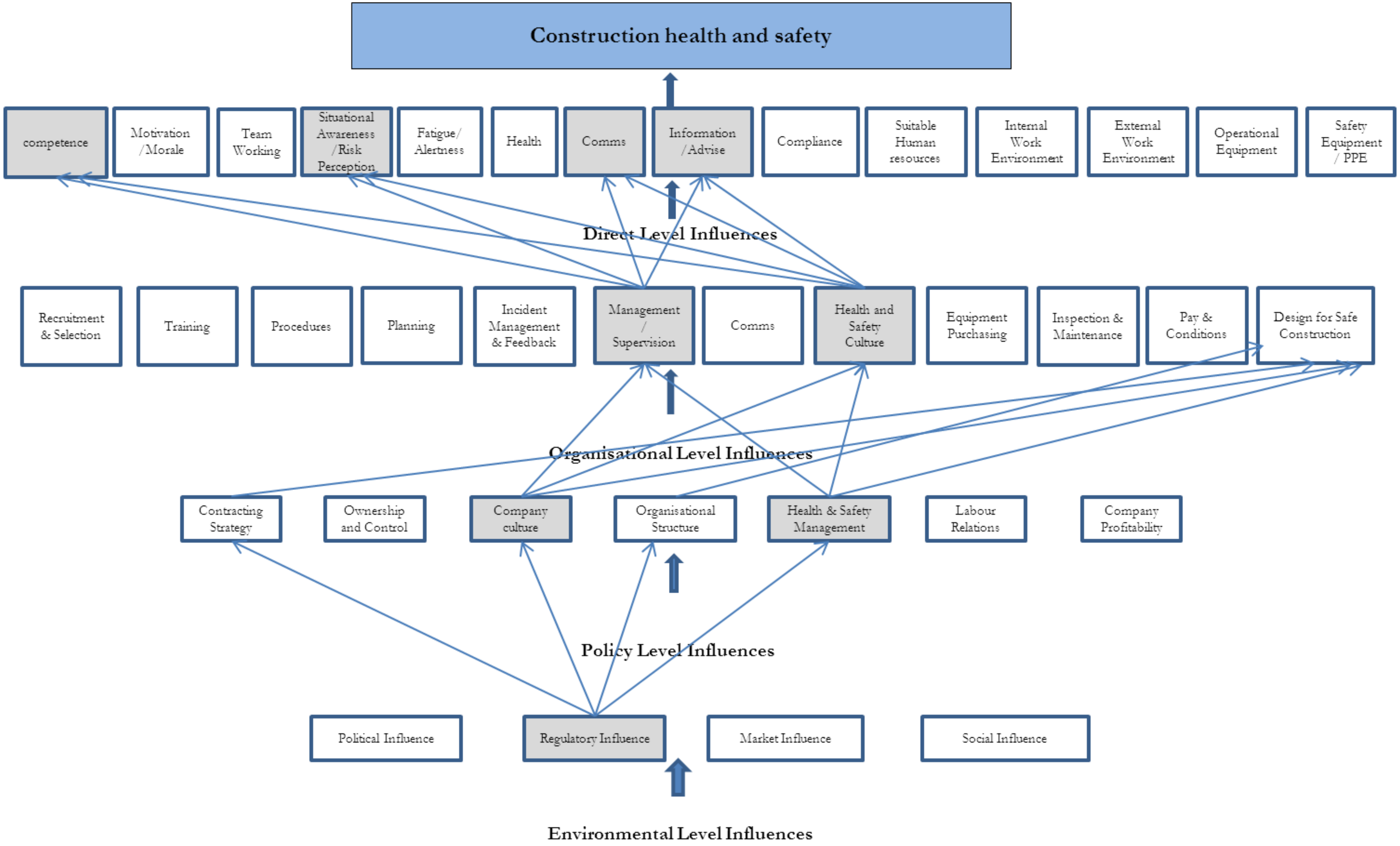

Figure 2.4: The influence network for construction health and safety management (Source: Bomel, 2004)

The Donaghy Report

The Donaghy report has been recognised and referred to on many occasions (e.g. Atkinson and Westall, 2010; Rawlinson and Farrell, 2010; Manu *et al.*, 2010; Gilbertson *et al.*, 2011; Mzyece *et al.*, 2012a; Ndekugri, 2013; Sherratt *et al.*, 2013). The report contains several issues identified as underlying causes of fatal accidents. It was written in response to the then Secretary of State for Works and Pensions the Rt. Hon James Purnell. Undertaken in three phases, it reviews and analyses various material. Under Phase 2 for example, a review was undertaken to identify the causes of fatal accidents in construction.

The conclusion drawn from the Donaghy report states that, "[…] the responsibility for safety already lies clearly with the Contractor and this responsibility needs to be further clarified in order to raise standards and assist the courts when considering alleged breaches of health and safety" (see Paragraph 19). Indeed, this resonates with the CDM 2007 shared responsibility ethos. Further, paragraph 151 of the same report emphasises that, there is need for the university curriculum to be revised to include pertinent H&S issues and the CDM Regulations. Once the graduates are equipped with appropriate knowledge, it is predicted that this would benefit the industry and directly influence improved H&S performance (Donaghy, 2009). Thus, this report demonstrates how considering issues such as training and reviewing of regulatory regimes can improve H&S.

The Löfstedt Report

More recently, the Löfstedt report, published in November 2011, addressed the issue of reducing the burden of H&S regulations on businesses across various industries in the UK. Löfstedt (2011) acknowledges the concerns surrounding the regulations, chief of which were: (a) overlapping of competence training qualifications, (b) the requirement of competence, extending beyond the TMCS Directive requirements, and (c) an overly complicated ACoP. These concerns, considered widespread, triggered the recommendation for a complete overhaul of the ACoP that accompanies the CDM 2007. The background of this recommendation was to: (a) ensure that the expression of duties is clearer, and (b) reduce bureaucracy and provide appropriate guidance for smaller projects. Issues such as industry collaboration to identify best practice were also considered critical.

Perhaps the most striking observation from these reports is the need to balance the issues. For example on one hand, Donaghy (2009) advocates for training while on the other, Löfstedt (2011) criticises the overly bureaucratic training process, although arguably, the context of the training requirements differ. Despite this view, such training is aimed at specific H&S performance deterrents.

2.2.5 Integration of H&S into project planning

Numerous studies suggest integrating H&S into project planning and management (e.g. Kartam, 1997; Hare *et al.*, 2006; Cameron and Hare, 2008; Hare and Cameron, 2012). For example, Kartam (1997) developed a framework for a computerised safety and health knowledge-intensive system, embedded within the Critical Path Method (CPM) software. Hare *et al.* (2006) found three main critical factors that promote integration of H&S into pre-construction planning (i.e. concept and feasibility, design and integrated teams). Whereas Cameron and Hare (2008) developed eight planning tools, which support project planning and H&S issues concurrently. That is, (i) a responsibility chart, (ii) an option evaluation chart, (iii) health and safety hazard workshops, (iv) safety information on drawings, (v) red-amber-green lists, (vi) health and safety milestones on programmes, (vii) design change control process and (viii) interaction tools. Table 2.4 provides a summary of key attributes that trigger improved H&S performance.

Table 2.4: Factors/attributes that contribute to improved H&S performance

Author(s) \ Factors/ attributes that contribute to improved H&S performance	Design decisions (e.g. PtD)	Legal framework	Risk Assessment /management	Leadership commitment and management participation	Integrated construction planning	Safety culture	Safety climate	Training	Organisational responsibility/ethos	Worker behaviour modification	Role recognition	Knowledge management/Use of accident information	Communication	Community practice(s)/norms/trends	Trust	Competence	Safe Subcontracting
Jaselskis *et al*. (1996)								✓					✓				
Kartam (1997)					✓							✓					
Gherarchi *et al*. (1998)									✓					✓			
Hinze *et al*. (1998)				✓								✓					
Gambatese and Hinze (1999)	✓																
Sawacha *et al*. (1999)				✓				✓	✓	✓		✓		✓			
Mohamed (1999)				✓													
Abdelhamid and Everett (2000)				✓				✓				✓					
Baxendale and Jones (2000)		✓			✓						✓						
Kartam *et al*. (2000)		✓		✓				✓	✓					✓			✓
Suraji *et al*. (2001)		✓	✓	✓	✓				✓			✓				✓	✓
Griffith and Phillips (2001)		✓		✓													
Toole (2002)									✓		✓						✓
Hide *et al*. (2003)	✓		✓	✓	✓		✓		✓				✓			✓	
Gibb *et al*. (2006)				✓					✓								
Huang and Hinze (2006)			✓	✓	✓												✓
Abudayyeh *et al*. (2006)				✓		✓					✓						
Loosemore and Andonakis (2007)		✓						✓					✓				
Joyce (2007)		✓									✓					✓	
Cameron and Duff (2007)				✓						✓							
Cameron and Hare (2008)					✓												
Zhou and Zhang (2008)			✓	✓													
Dingsdag *et al*. (2008)								✓		✓		✓	✓				
Wamuziri (2010)		✓				✓	✓										

Factors/ attributes that contribute to improved H&S performance / **Author(s)**	Design decisions (e.g. PtD)	Legal framework	Risk Assessment /management	Leadership commitment and management participation	Integrated construction planning	Safety culture	Safety climate	Training	Organisational responsibility/ethos	Worker behaviour modification	Role recognition	Knowledge management/Use of accident information	Communication	Community practice(s)/norms/trends	Trust	Competence	Safe Subcontracting
Wilkins (2011)								✓				✓				✓	
Conchie *et al*. (2011)															✓		
Manu *et al*. (2012)		✓													✓		✓
Ismail *et al*. (2012)												✓	✓				
Hale *et al*. (2012)			✓													✓	
Lingard *et al*. (2012)									✓								
Swuste *et al*. (2012)	✓			✓								✓					
Van Der Molen *et al*. (2012)		✓						✓	✓	✓						✓	
Biggs *et al*. (2013)				✓		✓	✓										✓
Cameron *et al*. (2013)								✓									
Frequency	***3***	***9***	***5***	***15***	***6***	***3***	***3***	***9***	***9***	***4***	***4***	***9***	***5***	***3***	***2***	***6***	***6***

2.2.6 Accident precursors and near misses information

Historical accident and near miss records have been identified as viable sources of information to improve safety performance (cf. Behm and Schneller, 2013). For example, Wu *et al*. (2010) developed a systematic mechanism to interrupt and prevent precursors and near misses (or immediate factors). Having sent out 241 questionnaires to safety managers of UK construction companies to examine the results of precursors derived from the proposed model, 43 were returned representing an 18% response rate. Their study thus proposes an approach to facilitate accruing valuable information from historical accident records to improve safety. Other studies even conclude that the lack of accident data is a serious cause for concern (Brace *et al*., 2009).

From the discussion in the preceding subsections, it is clear that numerous efforts have been made suggesting ways of improving H&S performance. While other studies underscore the advantages of utilising a cost benefit analysis to enhance safety performance (see e.g. Ikpe *et al*., 2011) or even goal setting (see e.g. Cameron and Duff, 2007). The issues suggested are diverse, complex, wide ranging and vary considerably, such that it is difficult to conclude that one attribute is more suitable, albeit an attempt to do so is summarised in Table 2.4. This summary shows that leadership commitment had the highest frequency, hence considered critical towards improved H&S performance.

2.3 CAUSES OF ACCIDENTS IN THE CONSTRUCTION INDUSTRY AND ACCIDENT CAUSATION THEORIES

A number of studies have shown considerable interest in the area of causes of occupational accidents and ill health, particularly in the construction industry (e.g. Suraji *et al*., 2001; Gambatese *et al*., 2008; Manu *et al*., 2012; Swuste *et al*., 2012). The theories of accident causality and the underlying issues are often perceived to be complex and multi-faceted.

It is therefore unsurprising that varied research has been undertaken on accident causation. For example, in the context of the UK construction industry, Gibb *et al.* (2006) developed a causality model having studied some 100 construction accidents and primary data obtained from focus groups. Gibb *et al.* (2006) conclude that stakeholders with immediate accident circumstances, shaping factors, and originating influences must ensure the removal of flaws within their safety systems to reduce accidents as illustrated in Figure 2.5. Based on the same data, an earlier study by Haslam *et al.* (2005) argued that paying attention to the originating influences is crucial.

Other earlier studies have attempted to explain these factors alluded to by Haslam *et al.* (2005) and Gibb *et al.* (2006). Originating from Reason's theories, they relate to the Swiss cheese as described in Section 2.3.1. Whilst these studies demonstrate the universal application of this theory within various fields respectively, it is worth noting that latent features play a critical role towards accident causation. However, without being carried away with the plethora of research on these theories, as they are discussed subsequently, this section highlights major causes of accidents as determined by various authors.

A study conducted by Abdelhamid and Everett (2000) identified three root causes of accidents:

- failing to identify conditions which are unsafe prior to the start of an activity;
- having to proceed with an activity after a condition has been identified as unsafe by a worker; and
- acting unsafely regardless of initial conditions.

Identifying these root causes was accomplished by developing a model known as the Accident Root Causes Tracing Model (ARCTM).

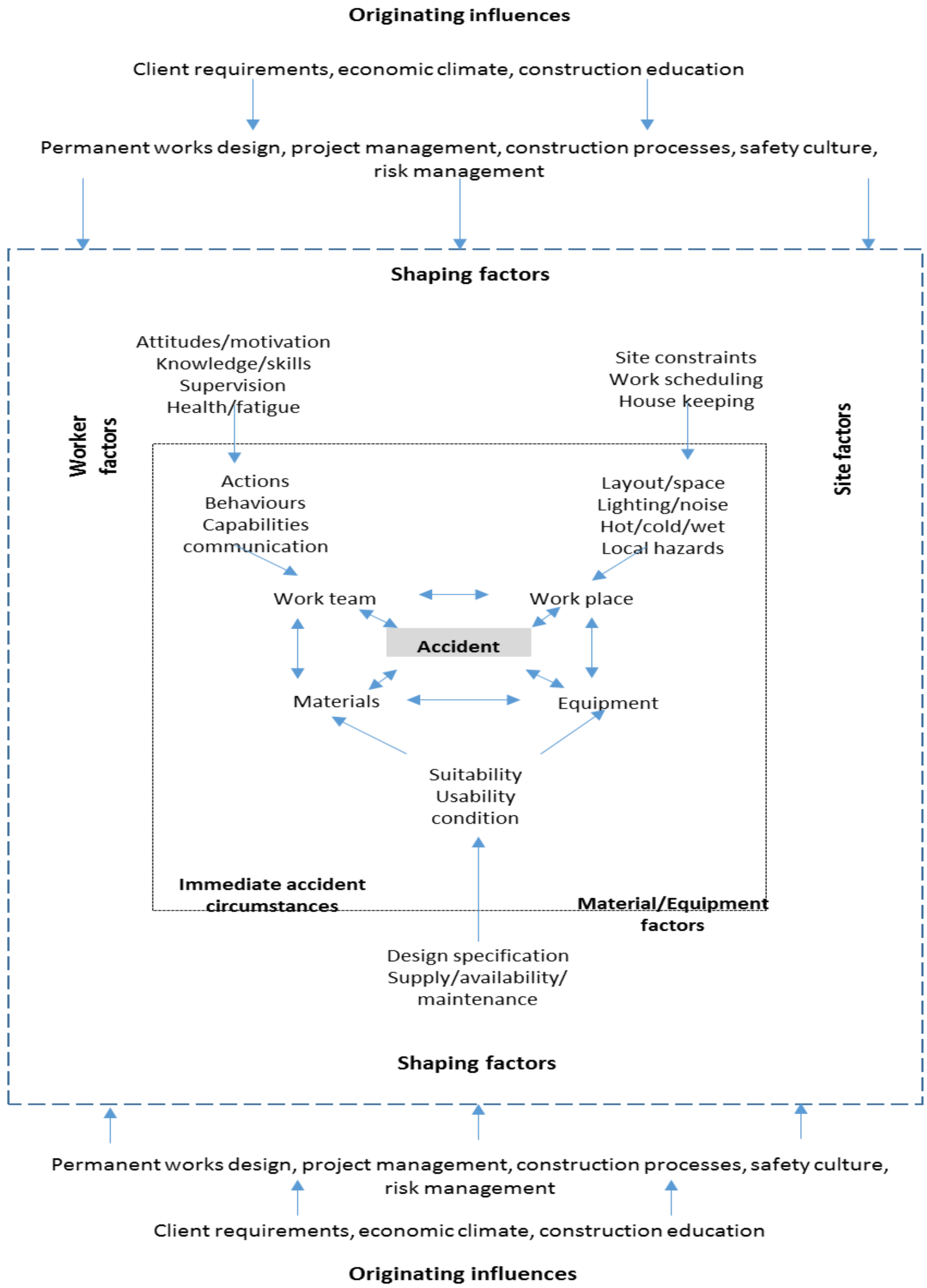

Figure 2.5: Loughborough's hierarchy of causal influences in construction accidents: the ConCA accident causality model (Source: Haslam *et al.*, 2005)

Mitropoulos *et al.* (2005) developed a systems model to understand and address causal factors that lead to accidents during a construction activity. Having examined the limitations of safety strategies at the time, Mitropoulos *et al.* (2005) proposed two accident mitigation strategies, that is: "(1) reliable production planning to reduce task unpredictability, and (2) error management by way of increasing the workers' ability to avoid, trap, and mitigate errors".

Further, Edwards and Nicholas (2002) examined accident statistics obtained from the HSE and revealed that off-highway plant and equipment considerably contributed to the accident record of the UK construction industry. It was observed that this outcome partly had to do with poor mechanical design and largely the fault of operatives. The training programmes initiated at the time were limited due to a lack of mandatory certification. As such, to address this challenge they hypothesized that "the development of a psychometric test for assessing the health and safety aptitude of construction plant operatives" was a viable replacement of the initial training programmes.

Brace *et al.* (2009) on the other hand explains the causes of accidents within three categories, namely:

- broader societal and industry wide influences (macro);
- project and process factors (mezzo); and
- worker/supervisor/workplace hazard causes (micro).

Table 2.5 provides a detailed description of the three categories. Having identified the causes of accidents, Brace *et al.* (2009) propose improvement strategies to resolve the identified impediments to safety performance. The improvement strategies, largely defined within three themes (i.e. enforcement and compliance, competency and training and culture and mind-set), were evaluated to determine their viability. The findings from the evaluation show that enforcement and compliance yielded the highest score in terms of priority, while competence and training was the most promising.

Indeed, this issue of training at the micro level has been widely recognised by various researchers (e.g. Wilson, 1989; Teo *et al.*, 2005; Hare and Cameron, 2011). In the United States for example, Wilkins (2011) assessed the perceptions and knowledge of training received by construction workers. The results showed that in the main, the workforce was dissatisfied with the effectiveness of training and there was evidence of a lack of integrated adult learning characteristics.

Table 2.5: Causes of accidents at macro, mezzo, and micro levels

	Causes of accidents defined under three categories (or levels)		
Item	**Macro**	**Mezzo**	**Micro**
A	Immature corporate systems	Immature project systems and processes	Shortage of competent supervisors
B	Inappropriate enforcement	Inappropriate procurement and supply chain arrangements	A lack of individual competency and understanding of workers and supervisors
C	Lack of proper accident data	Lack of understanding and engagement by some of the design community	The ineffectiveness or lack of training and certification of competence
D	Lack of leadership from 'Government'	Lack of proper accident investigation/data	Lack of ownership
E	Lack of influence of trade unions in practice/on site	Lack of organisational learning	Engagement and empowerment of, communication with and responsibility for workers and supervisors

Source: Brace *et al.* (2009)

Furthermore, beyond training, Brace *et al.* (2009) noted that item (E) under the micro level was exacerbated by poor behaviour, cost pressures, poor equipment (including personal protective equipment) and its misuse, and site hazards (cf. Bomel Ltd, 2003). In view of the CDM Regulations, it can be argued that the criticisms of CDM implementation resonate with the outcomes presented in Table 2.5 (see Section 4.4). For example industry commercial pressure (see e.g. Frontline Consultants, 2012a), lack of understanding of roles (see e.g. ICE, 2011), and inadequate duty holder competency (see e.g. SEC, 2010) are common impediments which relate to the mezzo and micro levels. Given such a background, it is conceivable that the insufficient discharge of CDM duties may lead to accidents. Moreover, what is more critical is the magnitude of such an accident, given that the implications for major accidents are severe. For example, Gilbertson *et al.* (2011) found that major or catastrophic incidents caused "extensive delay or project failure, significant business impact, loss of money and loss of reputation for all concerned." Of which undesirable consequences such as multiple casualties on and off-site among others, were commonplace. Besides the consequences mentioned above, these events are likely to result in adverse effects on the organisation's commercial viability, image, and financial profitability, more so when the organisation is found culpable.

Gilbertson *et al.* (2011) further identifies other wider implications such as (a) the police and the HSE taking over the sites for a number of days or even weeks, and (b) post event/long-term impact on families and the public. However, it was concluded in the same study that under tier one "failure to recognise hazardous scenarios and influencing factors was the most significant factor in major hazard events", while 15 other factors relate to tier two. At tier 3, it is identified that the lack of robustness, overcomplicated procurement leading to unclear responsibilities and human error were the leading causes. The fourth tier refers to issues such as underfunding, over reliance on software and codes, while the last tier (5) identifies vandalism and malicious acts as causes.

Considering the discussion above, it is clear that major accidents may trigger severe repercussions. It was also revealed that the causes of such events are wide-ranging, complex and often triggered by some underlying failures involving humans, design or even construction activities (e.g. Hide *et al.*, 2003; Mann, 2008). As such, these studies demonstrate that accidents are often caused by underlying factors.

Having identified several models that attempt to describe accident causation, Loughborough's model is widely acknowledged because of its holistic approach. This view was reached by Behm and Schneller (2013). Other researchers have even attempted to apply it in the context of H&S performance improvement (e.g. Gibb *et al.*, 2006; Brace *et al.*, 2009; Wu *et al.*, 2010). Behm and Schneller (2013) applied Loughborough's ConCA model to the State Department Transportation construction accidents as a tool for organisational learning. As such, this demonstrates that it is a viable model towards H&S performance improvement, despite a different setup. To clarify this issue further, the next section discusses the key principles and theories in relation to accident causality.

2.3.1 Accident causation and human error theories

Based on the work of Heinrich (1936), accident causation theories have evolved rapidly (Lingard and Rowlinson, 2005). The influential work of Heinrich argues that 88% of the accidents are due to unsafe actions (i.e. behaviour of workers), 10% by unsafe conditions (i.e. mechanical or physical hazards), and 2% by acts of God (Raof, 1998; Lingard and Rowlinson, 2005). This was a culmination of Heinrich's work proposing a five-factor accident sequence, namely: (i) ancestry and social environment, (ii) personal factors, (iii) unsafe acts or conditions, (iv) accidents, and (v) injuries. It is illustrated graphically by lining up a group of dominoes and the falling domino triggers the occurrence of an incident. Although this theory has evolved and indeed modified by some (e.g. Bird and Loftus, 1976), the concepts behind the theory still remain significant. For example, the first domino is described as the one that encompasses the originating influence, similar to the architecture of models that are more recent (Lingard and Rowlinson, 2005).

Another widely acknowledged theory is the one developed by Reason (1990) also known as the human error theory (see Reason, 1997). It is argued that the various factors within an organisation (referred to as latent condition pathways), lead to an accident. The relevance of this model to H&S performance improvement is evident from Loughborough's ConCA model discussed earlier.

Other researchers also show this relationship clearly (e.g. Gibb *et al.*, 2006). It is conceived that because of human error, the plates have holes. Figure 2.6 illustrates this phenomenon clearly. It is perceived that there are some holes due to active failures, while others are because of latent conditions. Once the holes are lined up, there is an opportunity for an accident to occur (Gibb *et al.*, 2006). It therefore follows that efforts towards reducing the holes may indeed interrupt the chance of an accident happening. Bomel Limited *et al.* (2006) examined various factors causing accidents, of which their study yielded significant discrepancies. For example, failure to comply with regulations was more common in the rest of Great Britain than Scotland, thus demonstrating the varied nature of accident causality.

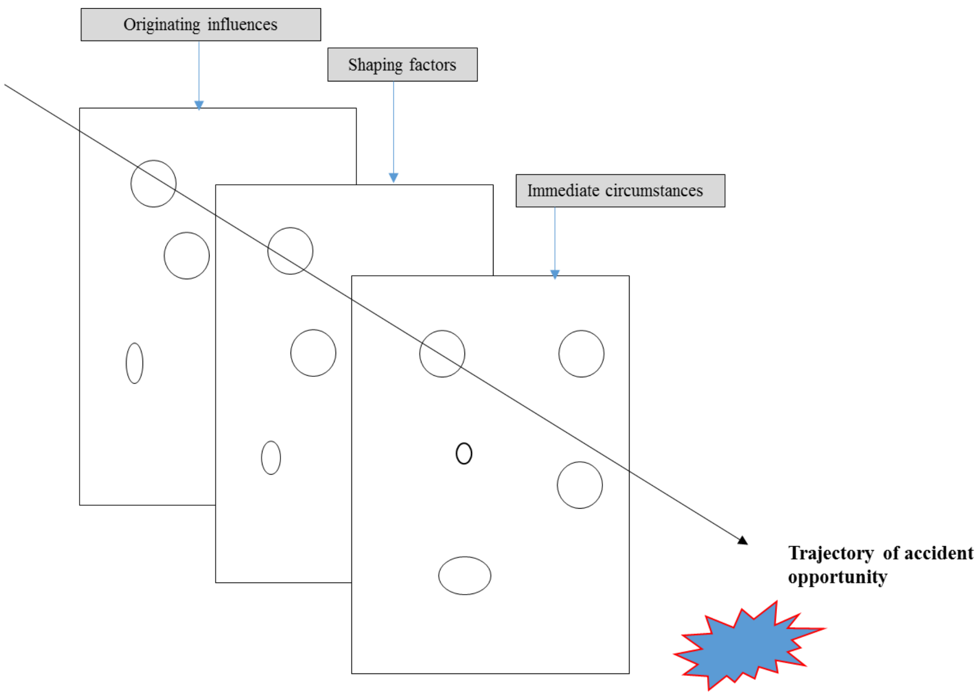

Figure 2.6: The Swiss cheese model (Source: Reason 1990; Haslam *et al.*, 2005)

In the context of a construction activity, it is reasonable to argue that the sequence and ordering of activities, and the various factors such as the procurement route among others, influence the ability for an accident to occur. To support this argument further, a study conducted by Hudson *et al.* (1991) demonstrates that, upstream decisions influence the occurrence of accidents. Figure 2.7 shows that by the time this decision reaches the system barriers, as long as the holes are aligned, it is likely for an accident to occur. In the context of construction H&S, Ndekugri (2013, p.133) clarifies this further by explaining that:

> *...the causal path of an accident as a ray of light and the impact of organisational safety systems and procedures as barriers across the path. A perfect barrier is completely impenetrable but, in practice, there are holes in it allowing the ray to pass through the next barrier. These holes represent weaknesses and shortcomings in the organisational safety systems and procedures* […].

It is clear from the theories that decisions made upstream and at various stages influence the probability of accident occurrence. In the context of CDM Regulations, it is reasonable to argue that decisions leading to the discharge of duties are crucial.

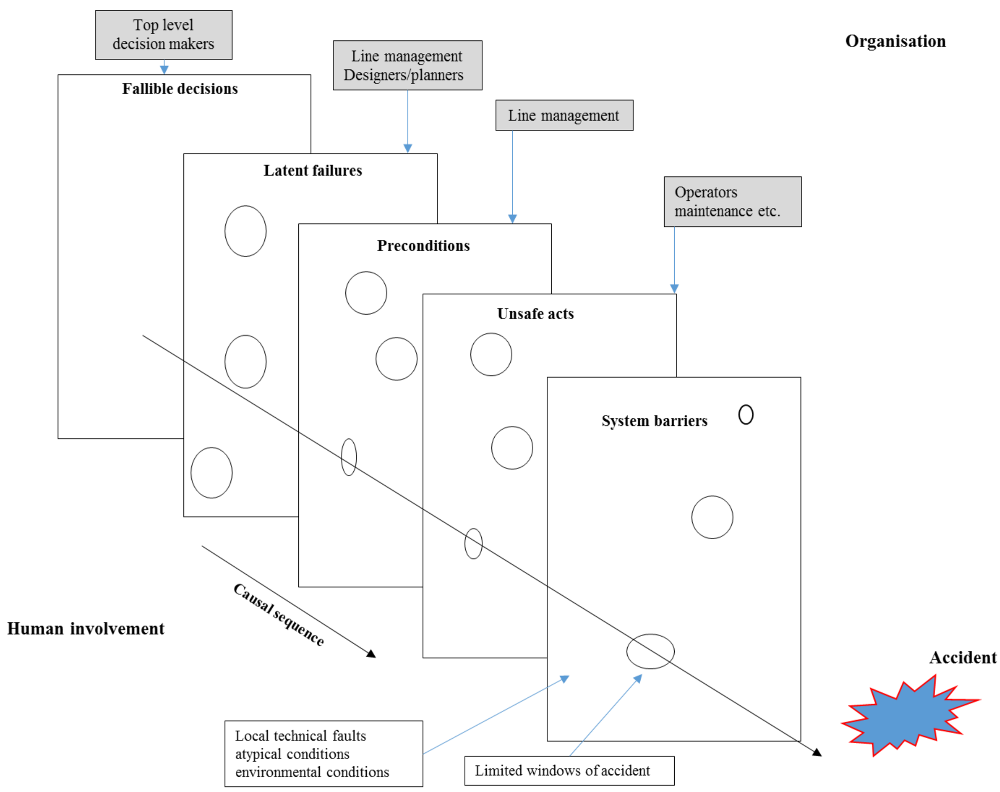

Figure 2.7: Accident causation sequence (Source: Hudson *et al.*, 1991)

Thus, it is logical to argue that the perception held by duty holders in relation to the degree of difficulty of duties, and the degree of importance, is likely to influence the extent of discharge of duties, and subsequently determine the likelihood of an accident to occur. It is within this context that the chapter partially informs the research questions (see Section 5.2) and responsive to objective four of the study, which was to collect primary data from key CDM stakeholders.

2.4 CHAPTER SUMMARY

The poor performance of the UK construction industry in relation to H&S is clearly shown, evident from latest statistics published by the HSE. Accidents and injuries can also be costly, not only in respect of the project cost, but also because of prosecutions. This chapter critically reviews literature in this respect. Besides discussing the statistics on accidents, it provides a thorough discussion on H&S performance improvement. Further, it is clear from the literature review that there are various causes of accidents, particularly in the context of the construction industry and its inherent activities. An exemplary study in this field shows that the causes of accidents may be defined at three levels (i.e. macro, mezzo, and micro). Interestingly, most of the causes alluded to resonate with the CDM implementation shortcomings. As such, it is unequivocally established that there is an indirect interplay between the CDM Regulations and accident causality. To identify the underlying principles behind the primary H&S legislation and explore theories that underpin its enforcement, the succeeding chapter examines the H&S legal framework in the UK construction industry.

CHAPTER 3: THE LEGAL FRAMEWORK FOR HEALTH AND SAFETY IN THE UK CONSTRUCTION INDUSTRY AND ITS ENFORCEMENT

3.0: INTRODUCTION

The previous chapter clearly establishes the state of H&S in the UK construction industry of which accidents are still a source of great concern evident from available statistics. Despite a gradual improvement, there is no room for complacency, as "one death is too many" (e.g. Donaghy, 2009). In support of this view, it is widely recognised that legislation offers the most far-reaching opportunity for accident mitigation (e.g. Bomel, 2001; Bomel 2004), thus considered as strategic intervention (e.g. Langford *et al*., 2000; Metherall, 2010). It is against such a background this chapter is developed to examine the H&S legal framework in the UK construction industry, thus meeting the second objective of the study. In Section 3.1, a discussion on the origin and underlying principles behind the primary H&S legislation is provided, while Section 3.2 introduces the role of the HSE as an authoritative body regarding H&S legislation enforcement. Sections 3.3 and 3.4, discuss the main duties of the HSE regarding H&S legislation enforcement. Finally, Sections 3.5 and 3.6 describe other H&S regulations relevant to the construction industry.

3.1 BACKGROUND AND ORIGIN OF THE PRIMARY HEALTH AND SAFETY LEGISLATION

It is well established that the current H&S legislation in the UK construction industry dates as far back as the 1920s (e.g. Anderson, 1992; Phillips, 2006). Additionally, it is chronologically established by Anderson (1992) that the first occupational H&S legislation began on 29 August 1833—regulating the labour of children and young persons in the mills and factories of Britain (Anderson, 1992). Thereafter, various other regulations followed, after which the Factories Act of 1961 came into force and after a decade, a report chaired by Lord Robens was published on 9 June 1972 (Lord Robens, 1972).

The responsibility of the committee appointed on 29 May 1970 was twofold. First, it had to review provisions made for the safety and health of employees and second, consider changes needed in major enactments or indeed the extent of voluntary action. While undertaking this review, the committee was also required to consider other actions that safeguard members of the public from hazards. A detailed account of the Robens report is discussed below.

3.1.1 Safety and Health at Work: Robens report of 1972

Given the unacceptable level of accidents in the 1960s, a committee was set up under the leadership of Lord Robens (Anderson, 1992). In order to meet the terms of reference pointed out by the then Secretary of State for Employment and Productivity (Right Honourable Barbara Castle, M.P.), the committee studied various material and held several discussions with individuals and organisations over a period of two years (Lord Robens, 1972). Coupled with this, the committee received 183 written submissions from individuals and organisations; held informal talks at various levels, and made on the spot visits (Lord Robens, 1972).

Prior to this review, it is revealed in the Robens report that previous inquiries only tackled segments of the H&S subject. Such inquiries included: "the 1876 Royal Commission on the Factory and Workshops Acts, the 1938 Royal Commission on Safety in Coalmines, the 1949 Gowers Committee of Enquiry on Health, Welfare and Safety in Non-Industrial Employment, and the 1951 Dale Committee of Enquiry on Industrial Health Services."

The Robens report contains some 500 paragraphs contained within 19 chapters. It highlights various problems associated with the then safety and health legislation and establishes the need for change. For example, it points out that there were too many laws, encouraging reliance on state regulation, rather than personal responsibility. The report also emphasises that the legislation at the time was "intrinsically unsatisfactory […], badly structured […]", complex, and administratively fragmented (see e.g. Lewis, 1975). Further, they strongly concluded that apathy was the main cause of accidents at work (see paragraph 13) (cf. Howells, 1972; Woolf, 1973). The H&S laws at the time were also reported to be industry specific, or even region specific, thus narrow in scope (Russ, 2011).

As such, the main ethos behind the Robens report was driven by simplifying legislation and adopting a self-regulatory style (Lingard and Rowlinson, 2005; Metherall, 2010). Although others expressed some level of doubt in terms of its practicality (e.g. Duncan, 1971), paragraph 77, stresses the importance of an industry driven approach to H&S. It is pointed out in the same paragraph that, "people within each industry should look for a tailor-made approach to safety and health, related to the industry's own circumstances". In view of this, the self-regulating approach at industry level seemed appealing.

It was anticipated that collaboration at various levels was also important and fundamental, given that "prevention lies with those who create the risks" (Browne, 1973). The report therefore describes the proposed new statutory framework by providing arguments for and against existing legislation of the time. Further, it recommended a unified approach to the administration of safety and health legislation. It was considered paramount to introduce "a separate self-contained organisation, clearly recognisable as the authoritative body responsible for safety and health at work" (Lord Robens, 1972).

Other paragraphs provide a detailed account on the form and content of the new legislation (see paragraphs 125 – 161). They suggest specifying duties of the employers and employees in an explicit manner. In addition, they identified the need for developing regulations under the Act in three main categories—i.e. (i) matters related to general forms of employment; (ii) issues related to specific hazards; and (iii) concerns addressing specific industries such as agriculture, mining, or construction and so on. Within these categories, the main themes that stood out regarding the application of the new Act at the time were:

(a) clearly identifying upon whom duties are placed;

(b) ensuring responsibilities are concurrent to an extent that the overlapping duties enhance protection of workers;

(c) existing legislation brought under a single administration rather than in its piecemeal form; and

(d) introducing non-statutory codes of practice and standards based on flexibility.

The other main features discussed in the report relate to the main function of the inspectorate and sanctions and enforcement. Under the inspectorate, it was determined that there were inadequacies with the system, rather than the individual inspectors. The committee obtained these views from organisations such as the local authority associations, public health inspectors, and sanitary inspectors among others. However, for the purposes of the report, most of the discussion involved central government inspectorates.

Thus, the conclusions drawn regarding the inspectorate point towards a multi-specialisation inspection, driven by in-depth safety audits and team visits (see paragraph 212). As for enforcement, the Robens report revealed that the Factory inspectorate was the most active in terms of prosecutions (see paragraph 259). It observed that most inspection visits would expose a number of breaches of the law, leading to criminal proceedings (Lord Robens, 1972). However, based on the evidence gathered, it was concluded that:

> *...the lengthy process of investigation, warning, institution of criminal proceedings, conviction and ultimate fine is not a very effective way of producing an early remedy for known unsatisfactory conditions* [see paragraph 260].

Considering this view held, it was recommended that there was need for an approach, which recognised that different situations called for different remedies. It was envisaged that this approach would provide an opportunity to determine the nature of the accident. Implying that in some instances, the focus would be on punishment, while misdeeds that were more frequent would invite constructive remedial action. They further recommended severe penalties for repeat offenders, by clearly spelling out individual prosecutions rather than those only involving corporate bodies.

In light of the above, the Robens report suggested giving powers to inspectors to issue a formal improvement notice, without the involvement of the courts. The notice would contain the remedial action to be undertaken, within a specified time limit (see paragraph 269). Failure to comply with the improvement notice would trigger discontinuation of affected activities. Beyond the improvement notice, it was recommended that inspectors would have the power to issue a prohibition notice. Arguably, both procedures would be subjected to an appeal process if contested by an employer as elaborated in paragraphs 272 and 276.

Paragraphs 381 to 395 discuss safety training. It was established that integrated safety training and specialised safety training are not mutually exclusive. In other words, there is a strong possibility for the two to occur at the same time. Furthermore, it was highly recommended that statutory provisions needed to be underpinned by safety training. In this way, addressing safety training concerns such as patchiness and inadequacy of provisions. From the preceding discussion based on the contents of the Robens report, key issues are established that address workplace H&S concerns (see e.g. Howells, 1972).

Further, it is also clear that the report is underpinned by the philosophy of a self-regulating style of legislation. Such an approach embraces a flexible approach, open to non-statutory codes of practice. Several inadequacies were identified and ways to curb them recommended. The strength of the report lies in its ability to address safety legislation holistically unlike previous reports such as, the 1938 Royal Commission on Safety in Coalmines (Howells, 1972, p.195).

Having critically analysed contents of the Robens report, the next section describes the Act that followed the Robens report. This form of content analysis of legislation is encouraged by Anderson (2013). He suggests that it provides the researcher with useful material, which can be utilised to reveal findings at the time.

3.1.2 The Health and Safety at Work etc. Act 1974 (HSWA 1974)

Having established that the HSWA 1974 was introduced on the basis and premise of the Robens report discussed above, it is clear that the main ethos of adopting a 'self-regulating' regime has worked and served many industries, despite its opposition during the early days (see e.g. Woolf, 1973). The evidence of adopting this approach is consistent with the provisions under the HSWA 1974. For example, Section 2(1) requires employers to take a leading role, to ensure safety, health, and welfare of employees (see also Article 9 of the Framework Directive 89/391/EEC). This was clearly established in the Robens report (see paragraph 129). Similarly, Section 3(1) requires employers to ensure the protection of workers not directly employed under them (James *et al.*, 2007). Forty years on the Act is still a 'force' to reckon with. Recently Hackitt (2014) highlighted its benefits and concludes that:

> *…the Health and Safety at Work Act has demonstrated it can be applied to new responsibilities and new demands, creating the framework for people to come home safe and well from a days work in any sector of the economy.*

The original Act comprises of 4 parts and 85 sections. The four parts are:

- Part 1 Health, Safety and Welfare in connection with work, control of dangerous substances and certain emissions into the atmosphere (i.e. Sections 1 to 54);
- Part 2 Employment medical advisory service (i.e. Sections 55 to 60);
- Part 3 Building regulations and amendment of Building (Scotland) Act 1959 (i.e. Sections 61 to 76); and
- Part 4 Miscellaneous and general (i.e. Sections 77 to 85).

Of paramount importance in the context of the construction industry, is Parts 1 and 3. In addition, in the context of the CDM Regulations, it can be observed that Part 1 is most relevant, although arguably, other sections of the Act are still relevant to some degree. For example, Sections 2 to 9 specify duties of employers, persons concerned with premises, persons in control of certain premises, manufacturers, and employees. These sections clearly demand imposing specific duties on stakeholders, consistent with the ethos behind the CDM Regulations. In a similar manner, Lewis (1975) made the following observation regarding the Act:

> *…the fact that duties are imposed upon designers, manufactures, importers and suppliers, thereby hopefully ensuring that safety considerations are built in from the earliest possible moment.*

Such an observation also resonates well with the PtD concept introduced earlier in Chapter 2; thereby undertaking a proactive approach to safety. Indeed since its introduction, it has been recognised as the most important safety statute and embraced widely despite new and emerging technologies (see e.g. Lewis, 1975; Hackitt, 2014). This is achievable because of its flexibility (see e.g. ICE, 2010a). For example, Section 1(1) clearly expresses the premise upon which the Act is formulated. It describes the provisions relating to protecting persons at work against H&S risks without specifying the type of work. Further, it specifies duties in relation to employers, self-employed persons, and persons other than employees.

In accordance with the recommendation by the Robens Committee (see e.g. Browne, 1973, p.88), Sections 10 to 14 stipulate the role and functions of the Health and Safety Commission (HSC) and the Health and Safety Executive (HSE). The former has since been abolished and is no longer in use. As such, only the main functions of the HSE are discussed in this chapter (see Section 3.2). Further, Sections 15 to 17 of the Act, discuss the H&S regulations and codes of practice, after which enforcement procedures are described in Sections 18 to 26. In terms of enforcement, Hutter (1986) advocates for proactive enforcement rather than reactive. It is widely accepted that there are advantages to be gained by embarking on a proactive enforcement route—i.e. (e.g. Browne, 1973):

- discovery of offences;
- educating the regulated;
- instructive for the enforcement agency;
- informs officials of what is going on in the workplace; and
- collection of data for agency policy making.

Besides other varied sections detailing general and miscellaneous issues, the Act also contains provisions on the Building Regulations, and amendment of Building (Scotland) Act 1959 under Sections 61 to 76. It is clear that the HSWA 1974 covers wide-ranging issues, some of which are generic and overarching (Anderson, 2007). They concisely embrace the 'self-regulating approach' as advocated for in the Robens report. Of course several attempts have been made to change sections of this law, although they have not been passed to the statute books (e.g. Dobson, 2013). Indeed, there is no doubt that adopting a 'self-regulating approach' is beneficial and outweighs the barriers. Some of the benefits reported include among others, cheaper monitoring and enforcement costs (see e.g. Ogus, 1995).

3.2 THE HEALTH AND SAFETY EXECUTIVE (HSE)

The Health and Safety Executive (commonly referred to as HSE), was introduced on 1 January 1975 (Lewis, 1975). Prior to its introduction, the Health and Safety Commission (HSC) was established in 1974 alongside the HSWA 1974 (HSE, 2013a; ICE, 2010b). Its origin is clearly traceable from the recommendation made by the Robens committee as established earlier (see e.g. Browne, 1973) and Sections 1, 10 and 11 of the HSWA 1974. On 1 April 2008, the HSC and HSE merged into a single authoritative body known as the Health and Safety Executive (HSE, 2009b). Almond (2008) defines the HSE as

> *…the government body with responsibility for promotion, enforcement, and monitoring of standards of occupational health and safety in the United Kingdom.*

Further, it is of particular importance to mention that, while other bodies have a role to play in the enforcement of H&S regulations, such as the local authorities, the responsibility of the HSE is one that covers industrial workplaces and hazardous installations (Almond, 2008, p.109). Clearly, this illustrates the importance of the role of the HSE as a key enforcement authority. As such is it common practice for the HSE to provide advice to employers, oversee strategic H&S decisions and policy creation (Almond, 2008). For example, it is under the HSE, that the Field Operations Directorate (FOD) operates as illustrated in Figure 3.1. Further, the construction division is one of twelve employment sectors managed by the FOD (Mather, 2004), as illustrated by Figure 3.2 (see HSE, 2014a).

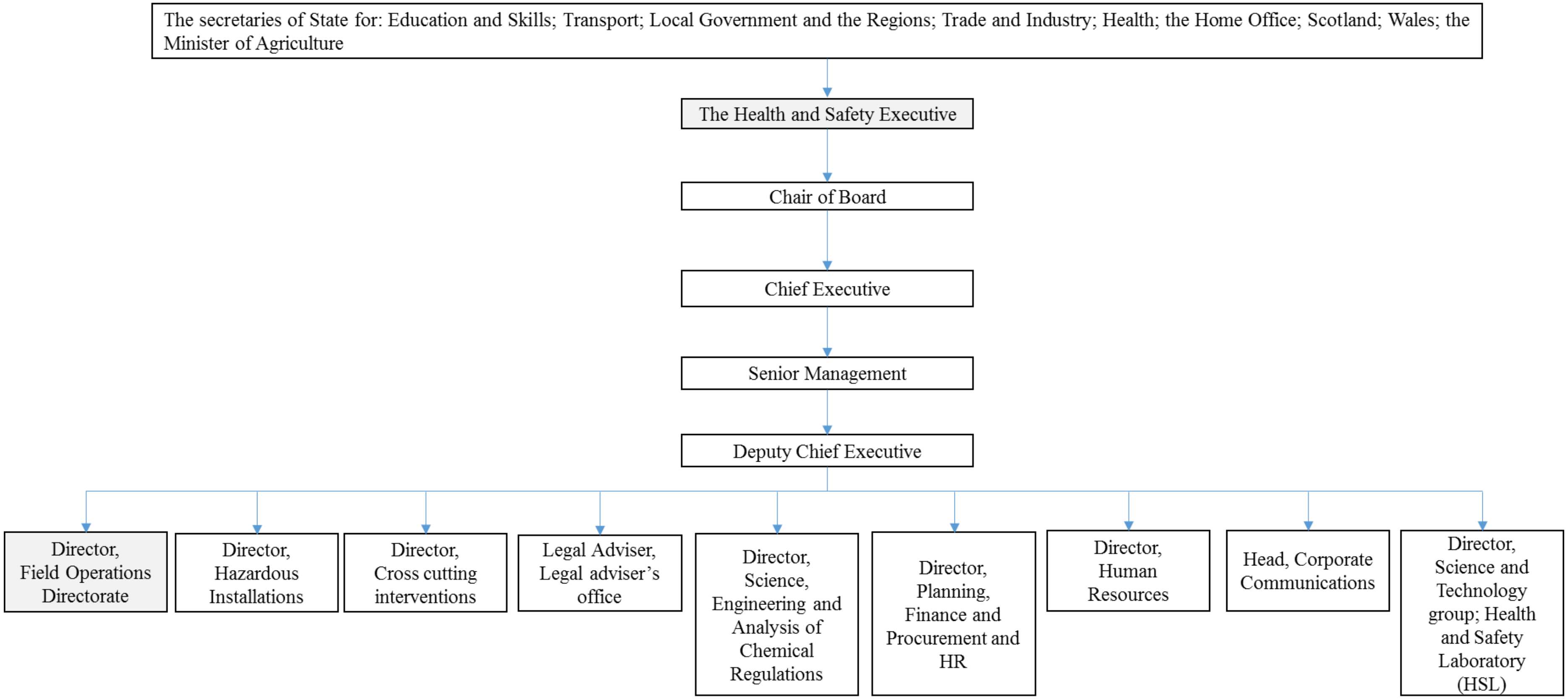

Figure 3.1: Organisation of the Health and Safety Executive (Adapted: Manase, 2008; HSE, 2014a)

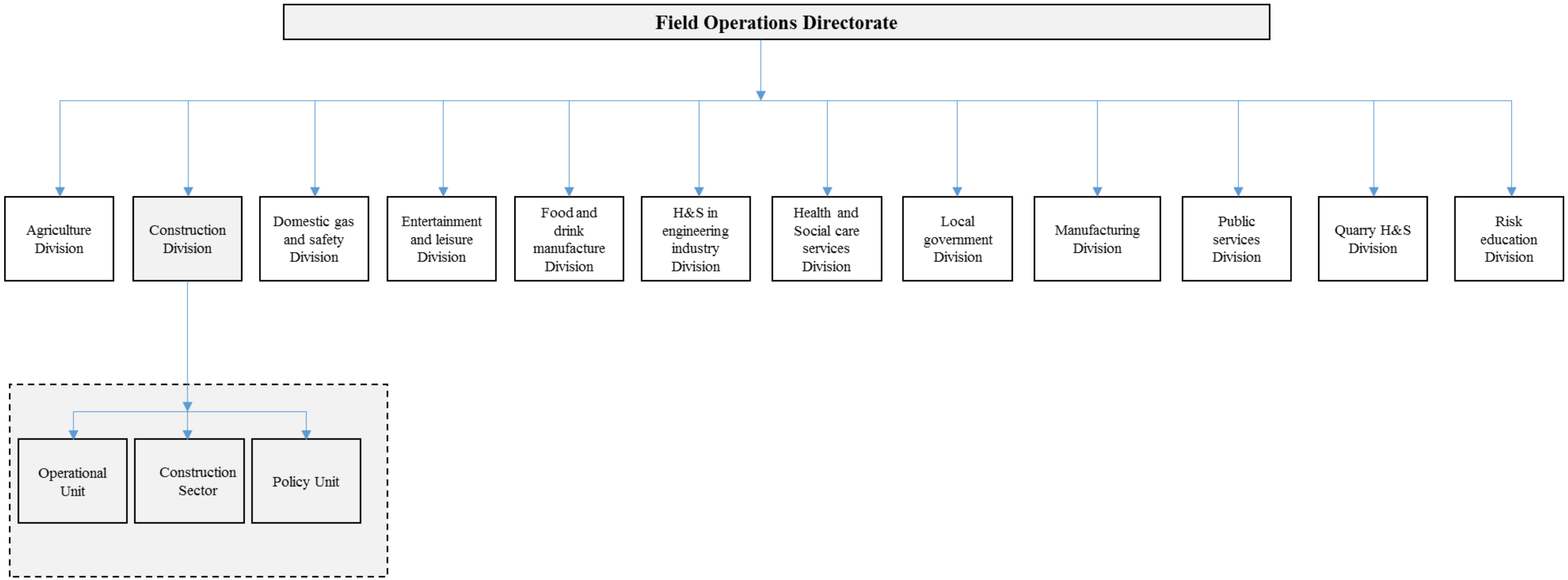

Figure 3.2: Field Operations Directorate (Adapted: Manase, 2008; HSE, 2013c)

3.3 MAIN DUTIES OF THE HSE IN THE UK CONSTRUCTION INDUSTRY

The HSE undertakes various duties that protect people at work and members of the public in terms of their health, safety and welfare (HSE, 2009b). Ndekugri (2013) emphasises that "…the HSE is an authority with the relevant enforcement responsibility". However, the onus is on those that create the risks to manage them in a practicable manner (Russ, 2011). In line with the construction industry, enforcement of H&S law is critical. Thus, the HSE carries out a number of functions in this regard. According to the HSE (2009b), their main functions include:

- proposing new or updated laws and standards;
- conducting research;
- providing information and advice; and
- making adequate arrangements for the enforcement of health and safety law in relation to specified work activities.

Notably, local authorities enforce H&S law in allocated workplaces. This also includes offices, shops, retail and wholesale distribution centres, leisure, hotel and catering premises (HSE, 2009b). In addition, for obvious reasons, the Office of Rail Regulation (ORR) is similarly responsible for enforcement of H&S law related to the railway (HSE, 2009b).

To enforce H&S law, the HSE carries out the following operations:

- inspection
- investigation
- complaints
- enforcement decisions
- notice
- prosecution

- major incident
- penalties
- work-related deaths.

A brief discussion on these responsibilities is provided in the subsequent subsections below.

3.3.1 Inspection

The HSE carries out inspections within a specific legal framework of duties, standards and sanctions (HSE, 2011). It involves assessment of a number of issues ranging from documents held by duty holders to observing site conditions, activities, practices and the like. It is also common practice for duty holders to be interviewed regarding work procedures. In this way, ensuring adherence to the legal requirements and promoting improved H&S standards within organisations (HSE, 2011). The inspectors who carry out these duties, and appointed by the HSE, use their own discretion to issue notices (see Hutter, 1986; ICE, 2010a).

The four main steps undertaken during inspection include (HSE, 2011):

- selection of inspection;
- planning and preparation (see Figure 3.3, which illustrates a proactive approach);
- conducting the inspection; and
- reporting, recording, and following up.

In addition, to achieve these four steps, inspectors must ensure that the following responsibilities are carried out—i.e.:

- ensuring that inspections are carried out in a proper manner that is planned and reported effectively;
- following appropriate enforcement procedures and decision making requirements; and
- meeting performance standards as agreed and specified or discusses suitable performance standards with line management when applicable.

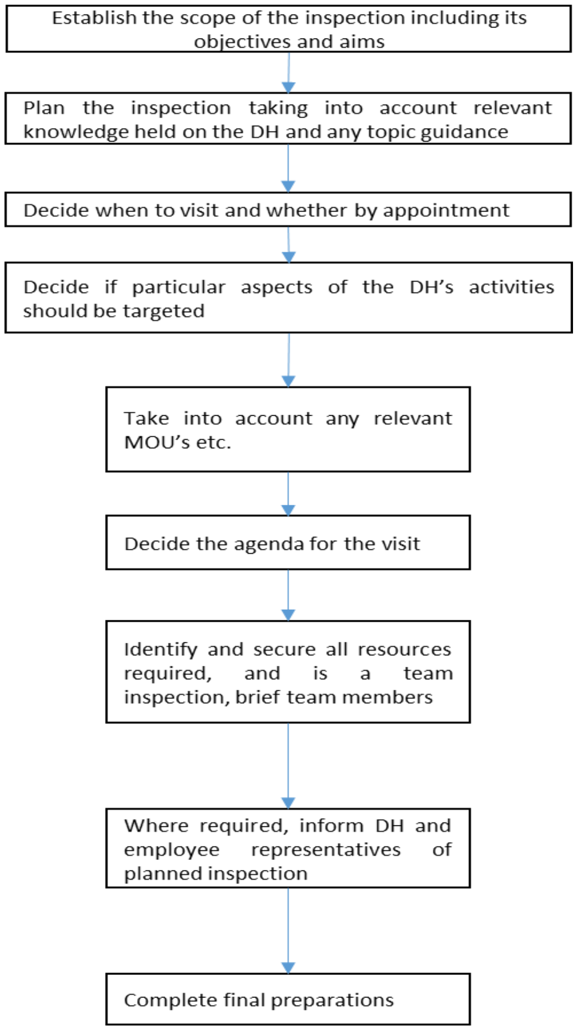

Figure 3.3: Planning and preparation procedure (Source: HSE, 2013c)

3.3.2 Investigation

As the name suggests, investigation involves gathering as much information regarding the incident (HSE, 2011). There are five main steps carried out by either a single inspector or a team of inspectors. The steps undertaken involve:

- establishing the facts of the incident or complaint;
- identifying the immediate underlying causes and lessons to be learnt from them;
- preventing recurrence of incident or complaint;
- detecting breaches of legislation; and
- taking appropriate action and subsequent enforcement.

From the above steps, it is clear that paying particular attention to the details that led to the incident or complaint is critical.

3.3.3 Handling of complaints

Circumstances that trigger a compliant about an activity originating outside the HSE require further investigation, provided the HSE is the enforcement authority (HSE, 2011). The HSE will undertake the necessary steps in the event where:

- the harm is significant;
- the compliant claims denial of basic employee welfare facilities; and
- there is a significant breach of law because of the complaint.

However, the HSE will not investigate a complaint if it is established that; first, there were no reasonably practicable precautions taken; and second, when it is impracticable to follow-up, let alone undertake the investigation (HSE, 2011).

3.3.4 Enforcement decisions

Having established the facts of an incident or complaint, the enforcement decision follows suit. The Enforcement Policy Statement (EPS) (HSE, 2009b) states that, "enforcement is distinct from civil claims for compensation and is not undertaken in all circumstances where civil claims may be pursued […]". Given this insight, enforcement principles include proportionality, targeting, consistency, transparency, and accountability; all considered as important elements, thus assisting the enforcement authority before reaching a decision (see Section 3.4).

3.3.5 Issuing notices

Two kinds of notices are statutory and in line with provisions of the HSWA 1974. Broadly considered though, there are three kinds, one of which is non-statutory. The HSE (2011) define these notices under their operational procedures (see Section 3.4.1).

3.3.6 Prosecution

Prosecution has been defined as a punitive action that is taken against a duty holder (HSE, 2014b). To arrive at this decision, a process that is impartial, justified, and procedurally correct is followed (HSE, 2014b). The prosecution procedure involves three main steps. First, the available evidence is assessed; second, the prosecution report is prepared and approved; and third, legal proceedings follow thereafter (HSE, 2009c).

3.3.7 Major incidents

Incidents beyond the norm in terms of routine are referred to as major incidents (HSE, 2009d). For example, an incident that is bound to cause multiple injuries, cases of ill health and death or even extensive damage to property is considered as a major incident (*ibid*). In this respect, the HSE undertakes various duties in line with the policy on major incidents.

Once all the procedures are followed, including the discharge of specific responsibilities, the final report is prepared after which implementation of the recommendations follows.

3.3.8 Penalties

Once the prosecution is successful, the courts then decide a specific penalty to be imposed on the offender(s) (HSE, 2014b) or defendant once proven guilty. This is in line with the Section 33, clause 37 (as amended) of the HSWA 1974, which describes the offences and maximum penalties under the H&S legislation (HSE, 2009b). Tables 3.1 to 3.3 provide a detailed breakdown of these penalties. An outline of these penalties is explicitly detailed in the Health and Safety at Work (Offences) Act of 2008, which changed the 'terrain' of convictions and their consequences (see e.g. ICE, 2010a).

Table 3.1: Penalties for failing to comply with notices

Failing to comply with an improvement or prohibition notice, or court remedy order (issued under the HSWA 1974 Sections 21, 22 and 42)	
Lower court maximum	£20 000 and/or 12 months imprisonment
Higher court maximum	Unlimited fine and/or 2 years imprisonment

Source: HSE (2013c)

Table 3.2: Penalties for breach of general duties

Breach of Sections 2 to 6 of the HSWA 1974	
Lower court maximum	£20 000 and/or 12 months imprisonment
Higher court maximum	Unlimited fine and/or 2 years imprisonment

Source: HSE (2013c)

Table 3.3: Penalties for most other breaches

Most other breaches of the HSWA 1974 and breaches of all H&S regulations under the Act	
Lower court maximum	£20 000 and/or 12 months imprisonment
Higher court maximum	Unlimited fine and/or 2 years imprisonment

Source: HSE (2013c)

3.3.9 Work-related deaths

Where a work-related death occurs, the police take on the lead role in a joint investigation with the HSE; including other relevant enforcing authorities (HSE, 2014b). The aim of such an investigation is to determine whether there is sufficient evidence suggesting a serious criminal offence or gross negligence manslaughter or corporate manslaughter. In the case of Scotland, the offence might be that of culpable homicide or corporate homicide (Ndekugri, 2013; HSE, 2014b).

The functions of the HSE noted above, are broad and wide-ranging. From the explanation provided, it is clear that the HSE plays a pivotal role in enforcing H&S legislation. There are several procedures and practical steps to be undertaken in the case of notices, prosecution, and the subsequent penalties decided by the courts. It is therefore reasonable to suggest that H&S performance requires the seriousness it deserves and as such adhering to the regulations is critical. However, some authors have shown concern over the penalties imposed. Even the HSE themselves seem to suggest that the current general level of fines does not properly reflect the seriousness of H&S offences (see HSE, 2014b). Along the same lines, Ndekugri (2013) explains that "[…] industry's organisations need to treat the risk of prosecution as a serious possibility."

3.4 REGULATORY ENFORCEMENT

As highlighted in the previous section (see Section 3.3.4), one of the core functions of the HSE is enforcement of H&S legislation. Having identified the underlying principles that inform the enforcement action, this section sheds light on procedures undertaken to enforce the H&S law. This is in line with Sections 18 to 26 of the HSWA 1974. It is important however to highlight that the enforcement of the H&S legislation in the UK is based on the "so far as is reasonably practicable" (SFARP) premise (e.g. Anderson, 1992). As such, in order to perform enforcement, a framework developed by the HSE guides inspectors to arrive at such a decision (HSE, 2013c). The framework known as the Enforcement Management Model (EMM), describes the purpose of enforcement. It suggests that the EMM,

- ensures duty holders take immediate action to address serious risks;

- promotes sustained compliance in an achievable manner; and
- ensures duty holders are accountable for their decisions and actions, and brought to the courts in the event of breaches.

In order to apply the EMM, it is strongly advised that the enforcement action should be underpinned by the EPS (HSE, 2013c). This reinforces the need to ensure that the enforcement action is proportionate to the H&S risks and degree of seriousness of breaches (HSE, 2013c). This issue of enforcement strategies has been debated over a considerable period. For example, Hutter (1986) was of the view that there are two concepts underlying enforcement (i.e. proactive and reactive). Proactive enforcement was defined in that study as one that involves routine checking, surveillance of workplaces, and if appropriate, sampling procedures by way of spot-checks (Hutter, 1986, p.115). However, the bottom-line is that enforcement has to do with the level of risk associated with the work involved. Given this premise, it is vital that inspectors have the right amount of knowledge.

Furthermore, paragraph 12 of the EMM cautions inspectors of the importance of having a thorough understanding of the hazards and control measures associated with activities of each duty holder. Additionally, because of the uniqueness of each duty holder, it is recommended that inspectors exercise a wide discretion (HSE, 2013c). Such a judgement ensures that the enforcement action is proportionate to a particular situation.

The above discussion demonstrates that there are several procedures to be followed during enforcement. However, execution of these steps is not spared from challenges. A review report on enforcement by the Field Operations Directorate (FOD) shows a downward trend in prosecutions over a decade (HSE, 2010). The factors that led to this downward trend are not clear; however, it was considered that a more proactive approach had a role to play towards successful prosecutions (see Table 3.4). Although some proactive prosecutions that lack actual harm may be regarded as "technical offences" by the courts, it was recommended that providing "strong advocacy" and "explanation" of the reasons at court would suffice (HSE, 2010). Further, to understand the enforcement action in the context of reporting incidents (see relevant regulation under Section 3.4.2) and the associated procedures, the next sections provide a thorough discussion on notices.

Table 3.4: Enforcement notices (improvement, deferred and immediate prohibition)

Year	Construction	All industries
2007/08	2575 (33%)	7758
2008/09	2490 (31%)	8077
2009/10	3451 (35%)	9727
2010/11	3882 (35%)	11 038
2011/12	3370 (34%)	9910

Source: HSE (2013d)

3.4.1 Notices

3.4.1.1 Improvement notice

Where an inspector establishes that a person or duty holder contravenes the law, Section 21 of the HSWA 1974 orders the inspector to issue an improvement notice (HSE, 2011). The notice contains information regarding its issuance, specifying the contravened provisions requiring the person to remedy, and includes a compliance period of not less than 21 days (HSE, 2011). Most importantly, when issued, the improvement notice should serve its purpose; as such, the issues addressed have to be practical and agreed by the parties involved, otherwise it would be of no use. Figure 3.4 illustrates the factors to be considered and procedures for serving an improvement notice, and that a breach does not always lead to a prosecution (Metherall, 2010).

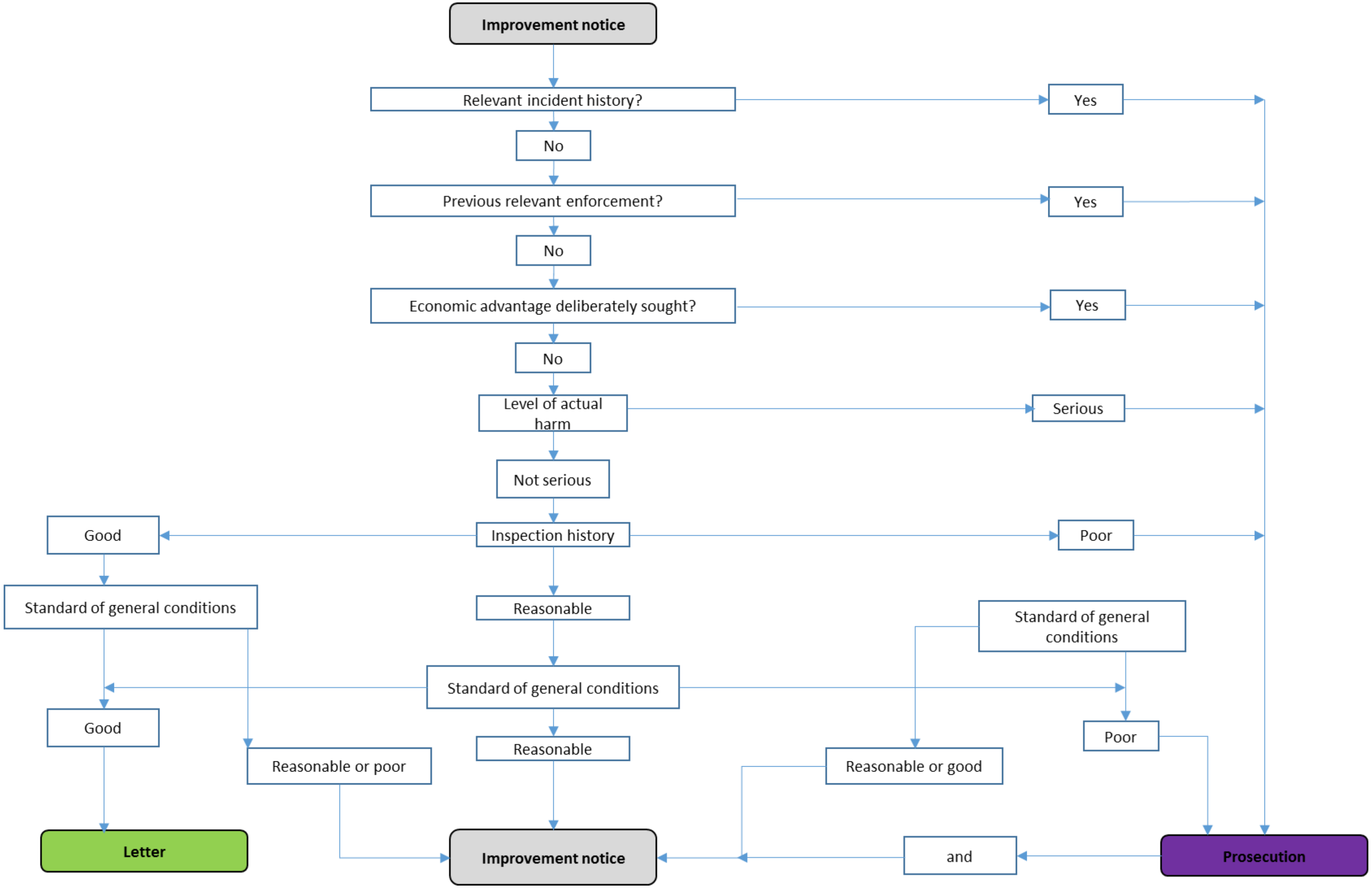

Figure 3.4: Improvement notice procedure (Source: HSE, 2013e)

3.4.1.2 Prohibition notice

The prohibition notice is served on the basis of Sections 22 and 23 of the HSWA 1974 (HSE, 2011). For example, in Section 22, the inspector is required to issue a prohibition notice, in the event where the activity being carried out may cause serious danger to the H&S of workers or others. Where an activity is previously executed in a dangerous manner, the notice is framed in the present tense because of the likelihood of reoccurrence. Apart from specifying the particulars highlighted above, the prohibition notice should also include details of the concerns and specify the activity that needs to be discontinued (HSE, 2011).

3.4.1.3 Crown notices

Unlike the previous two types of notices, based on specific requirements under the HSWA 1974, Crown notices are non-statutory (HSE, 2011). As such, they are the non-statutory equivalent of the improvement and prohibition notices and although not legally binding, the procedures to serve them are similar to the statutory ones.

3.4.2 Investigation

During the investigation process, various forms of evidence may be collected. These include witness statements, transcripts of interviews, documents, physical evidence, and evidence based on previous information held about the suspect (HSE, 2013f). Once the evidence is obtained, underlying causes of the incident are identified.

Another form of evidence that can be used is known as the expert evidence. Sometimes referred to as an expert witness, their role requires them to be impartial and present evidence that is independent and not influenced in any manner or form (HSE, 2013f). Once the defendant is identified and the prosecution approved, a pre-trail commences with preparing the case in readiness for the court stage (HSE, 2013f).

3.4.3 Court stage

There are various rules that must be adhered to during the court stage. For example, the HSE (2013e) provides a detailed explanation concerning admissible evidence. Therefore, it is critical to ensure that there is sufficient admissible evidence and whether additional evidence may be required (HSE, 2013e).

The hearing of H&S prosecutions occurs in a magistrates' court and involve various procedures. One of the most striking procedures is imposing the sentence. At this stage, it is critical that the fine reflects the offence by considering the relevant factors (HSE, 2013f). After the decision has been reached, the defendant can appeal to a higher court (HSE, 2013e).

To sum up, this section sheds light on the enforcement procedure. It defines and describes critical procedures that need to be adhered to in a consistent manner. As such, contextualises enforcement within H&S legislation and establishes the critical role played by the HSE. Specific H&S regulations within the broader context of the UK construction industry are discussed in the next section.

3.5 HEALTH AND SAFETY REGULATIONS IN THE UK CONSTRUCTION INDUSTRY

This section provides a discussion on regulations relevant to the UK construction industry in the context of H&S and most importantly in tandem with the CDM Regulations agenda. Of course, there are several regulations that apply to the construction industry; however, it is outside the scope of this chapter to address all the regulations concerned. Rather, the eight statutory instruments discussed here, are carefully chosen considering their relevance to H&S and proximity to the CDM Regulations. Establishing this association involved analysing the content of the provisions under the various statutory instruments. For example, Anderson (2010) identified three principle legal texts that are applicable to the construction industry; namely, the HSWA 1974, the Management of Health and Safety at Work Regulations (MHSWR) 1999 and the CDM 2007, of which the MHSWR 1999 are discussed below.

3.5.1 The Management of Health and Safety at Work Regulations (MHSWR) 1999

As the name suggests, the MHSWR 1999 reinforce the importance of workplace H&S. Formulated in line with HSWA 1974 (see Section 15), they comprise of 30 regulations and place specific duties on employers (Regulation 3(1)) and the self-employed (Regulation 3(2)), concerning risk assessment. This is consistent with the provisions stipulated under Regulation 9(1) of the CDM 2007. Further, they explain the application of principles of prevention (Regulation 4). This provision is also consistent with Regulation 7 of the CDM 2007 and the Framework Directive 89/391/EEC (see Article 6(2)). As such, these regulations implement the Framework Directive (e.g. Joyston-Bechal and Grice, 2004).

Regulation 8 on the other hand explains the procedures relating to a serious danger, while Regulation 11 encourages cooperation and coordination where two or more employers share a workplace (cf. Regulation 5 and 6 of the CDM 2007). Furthermore, Regulation 13 requires every employer to ensure that employees are competent regarding H&S (cf. Regulation 4 of the CDM 2007).

It can therefore be observed that there are similarities between the MHSWR and the CDM 2007. Several authors have arrived at this conclusion. For example, Ndekugri (2013) suggests that, the two regulations are applicable to the work environment of a consulting engineer, including the Building Regulations. Cameron *et al.* (2013) point out that the title of the "safety advisor" is in line with the MHSWR 1999. Under the CDM 2007, the "safety advisor" role is equivalent to the role of the CDM-C as noted by Cameron *et al.* (2013). This clearly shows the significance of the MHSWR in the context of the CDM 2007. Notably though, under schedule 4 of the CDM 2007 (which contains details of the revoked instruments), Regulation 27 of the MHSWR was revoked. This regulation described an amendment in the Construction (Health, Safety and Welfare) Regulations 1996 (CHSWR); however after the introduction of the CDM 2007, the entire statutory instrument (i.e. CHSWR) was revoked and therefore not discussed in great detail in this chapter.

3.5.2 Reporting of Injuries, Diseases and Dangerous Regulations (RIDDOR 2013)

Widely abbreviated and known by the acronym RIDDOR, this law requires employers, owners and persons in control of the workplace to report and keep records in relation to the following occurrences (HSE, 2013g):

- accidents that happen at work causing death;
- accidents that happen at work causing serious injuries;
- industrial diseases that are diagnosed; and
- dangerous incidents with the potential to cause harm.

This law came into force on 1 October 2013, replacing the RIDDOR 1995 and RIDDOR (Amendment) 2012. This is contained in the explanatory note of RIDDOR 2013 (2013). It comprises of 20 regulations and 4 schedules. Most importantly, Schedule 1 describes the procedures for reporting and recording accidents. For example, it explains that the relevant authority has to be notified within 10 days, accompanied by a report with particulars of the incident (see Part 1 of Schedule 1). Indeed, its relevance to H&S in the construction industry cannot be overemphasised, as such an important regulation; given the need to observe the rate of accidents (see Section 2.1).

3.5.3 The Work at Height Regulations (WHR) 2005

The widespread occurrence of accidents resulting from working at heights (e.g. Anderson, 2004), triggered the introduction of the Work at Height Regulations 2005 on 6 April 2005. It places specific responsibilities on the employer and those associated with working at height (Regulations 4 and 5). These regulations require that such works are planned appropriately (Regulation 4(1)(a)), supervised accordingly (Regulation 4(1)(b)) and executed in a manner that is as far as is reasonably practicable (Regulation 4(1)(c)). Further, they require the employer to ensure that those engaged to carry out such works are competent enough to do so (Regulation 5). These provisions are consistent with those under the CDM 2007—i.e. proper planning of construction work (Regulations 13(3), 15(b), 20(1)(b), 20(1)(c), 22(1)(f), and 24(c)) and the competence requirement of the workforce (Regulation 4). However, Anderson (2004) contemplates whether introducing new regulations was the best approach as opposed to updating existing laws, given that the Framework Directive does not require the WHRs. Although Anderson (2004) concludes that the WHRs were unnecessary, these regulations have been beneficial in practice (Cameron *et al.*, 2004; Beal 2007).

3.6 OTHER REGULATIONS WITH A BROADER CONTEXT APPLICABLE TO THE UK CONSTRUCTION INDUSTRY

Despite singling out regulations that relate to the CDM 2007, there are other regulations that are generally consistent with the CDM 2007 provisions, although in a broader context. It is outside the scope of this section to list such regulations, rather the aim is to demonstrate the extent of interplay.

3.6.1 Corporate manslaughter and corporate homicide Act 2007

Noncompliance with the CDM 2007 may result in breaches. This is contained in Regulation 45 of the CDM 2007. It states that

> *breach of a duty imposed by the preceding provisions of these Regulations, other than those imposed by regulations 9(1)(b), 13(6) and (7), 16, 22(1)(c) and (l), 25(1), (2) and (4), 26 to 44 and schedule 2, shall not confer a right of action in civil proceedings insofar as that duty applies for the protection of a person who is not an employee of the person on whom the duty is placed.*

Consequently, in the event of a fatal incident, the Corporate Manslaughter and Corporate Homicide Act 2007 (COMCHA) applies, obviously dependent upon the circumstances leading to the incident. For example, activities that lead to a gross breach of duty of care by senior management may trigger prosecution proceedings (ICE, 2010a; Metherall, 2010). Ndekugri (2013) examines this issue by highlighting its application to the consulting engineer in the context of five tests, namely:

- the organisation test;
- the duty of care test;
- the gross breach of duty test;
- the causation test; and
- the senior management test.

Of the five tests alluded to above, the causation test implies that the organisation's activities caused the death of the victim (Ndekugri, 2013, p.128). Further, Ndekugri (2013) points out the "risk of business failure associated with a conviction" under the COMCHA. Clearly, there is some association with the CDM 2007, given the shared responsibility ethos. In the same article, Ndekugri (2013) explicitly shows this relationship with H&S in the construction industry. However, Almond and Colover (2012) argue that, despite a drop in the rates of deaths and injuries resonating with improved H&S performance, there is also an issue of under-enforcement, given the number of prosecutions. Thus, they conclude that such legislation may produce intangible and hard to explain outcomes (cf. Walters, 2006).

3.6.2 The Personal Protective Equipment Regulations 1992, the Workplace (Health, Safety and Welfare) Regulations 1992, the Manual Handling Operations Regulations 1992 and the Provision and Use of Work Equipment Regulations 1998

The regulations discussed in this section largely apply to various places of work. However, their application in the context of the construction site as a workplace is relatively relevant. These regulations are part of regulations introduced in the early 1990s known as the "six-pack regulations" (Mulholland *et al.*, 2005; HSE, 2013a).

The MHSWR 1999 discussed in Section 3.4.1 are also part of the "six-pack regulations". The other regulations that were part of this suit of legislation were the Display Screen Equipment Regulations 1992 (Davies and Tomasin, 1996). Introduced on 1 January 1993, they were considered 'wide-ranging' and 'generic' rather than industry specific (Phillips, 2006). It is regarded that these regulations departed away from the prescriptive legislation style (Phillips, 2006). Rather, they encouraged a more generalizable approach; suiting various circumstances within organisations.

The most common recurring provisions in these regulations are for the employer to provide appropriate and sufficient equipment and systems and for employees to be knowledgeable of their use. For example, under the Personal Protective Equipment Regulations 1992, Regulation 10(1) suggests that every employer must ensure appropriate provision of needed equipment and similarly the use of such equipment by employees must be in accordance with the training provided (Regulation 10(2)). The Workplace (Health, Safety and Welfare) Regulations 1992, requires the workstations to be suitable and their use thereof (see Regulation 11). Similarly, the Manual Handling Operations Regulations requires employers to provide an adequate system of work and employees are required to make the most of such a system (see Regulations 4 and 5).

Given such an observation, it can be argued that they place specific obligations on the employer and the employee in the context of H&S. Indeed, this is consistent with the provisions of the Framework Directive that triggered development of the "six pack regulations" (see Davies and Tomasin, 1996, p.14).

Other notable and obvious regulations that are currently still relevant to the construction industry in the context of H&S include:

- the Health and Safety (First Aid) Regulations 1981 (1981);
- the Construction (Head Protection) Regulations 1989 (1989);
- the Electricity at Work Regulations 1989 (1989);
- the Health and Safety (Safety Signs and Signals) Regulations 1996 (1996);
- the Confined Spaces Regulations 1997 (1997);

- the Lifting Operations and Lifting Equipment Regulations 1998 (1998);
- the Control of Lead at Work Regulations 2002 (2002);
- the Control of Asbestos at Work Regulations 2002 (2002);
- the Control of Substances Hazardous to Health Regulations 2002 (2002);
- the Control of Noise at Work Regulations 2005 (2005); and
- the Control of Vibration at Work Regulations 2005 (2005).

Figure 3.5 provides an illustration showing the relationship between the primary and secondary legislation. Notably, the sequence of the secondary legislation (although not exhaustive) is arranged chronologically according to the year of publication. In addition, a concise historical perspective of H&S legislation that is relevant to the construction industry is captured and summarised in Figure 3.6. Notably though, only the CDM Regulations are reflected during the latter years, as such omitting more recent regulations for clarity purposes. Ideally, it would be realistic to assume that the present regulations provide a favourable platform for addressing H&S concerns in the UK construction industry. However, the picture drawn shows a path of continuous learning and modification. For example, Löfstedt (2011) recommends merging the PUWER 1998 with the LOLER 1998 (cf. Mattews, 2012). Indeed, such efforts towards improving the overall outlook of H&S in the UK construction industry are commendable.

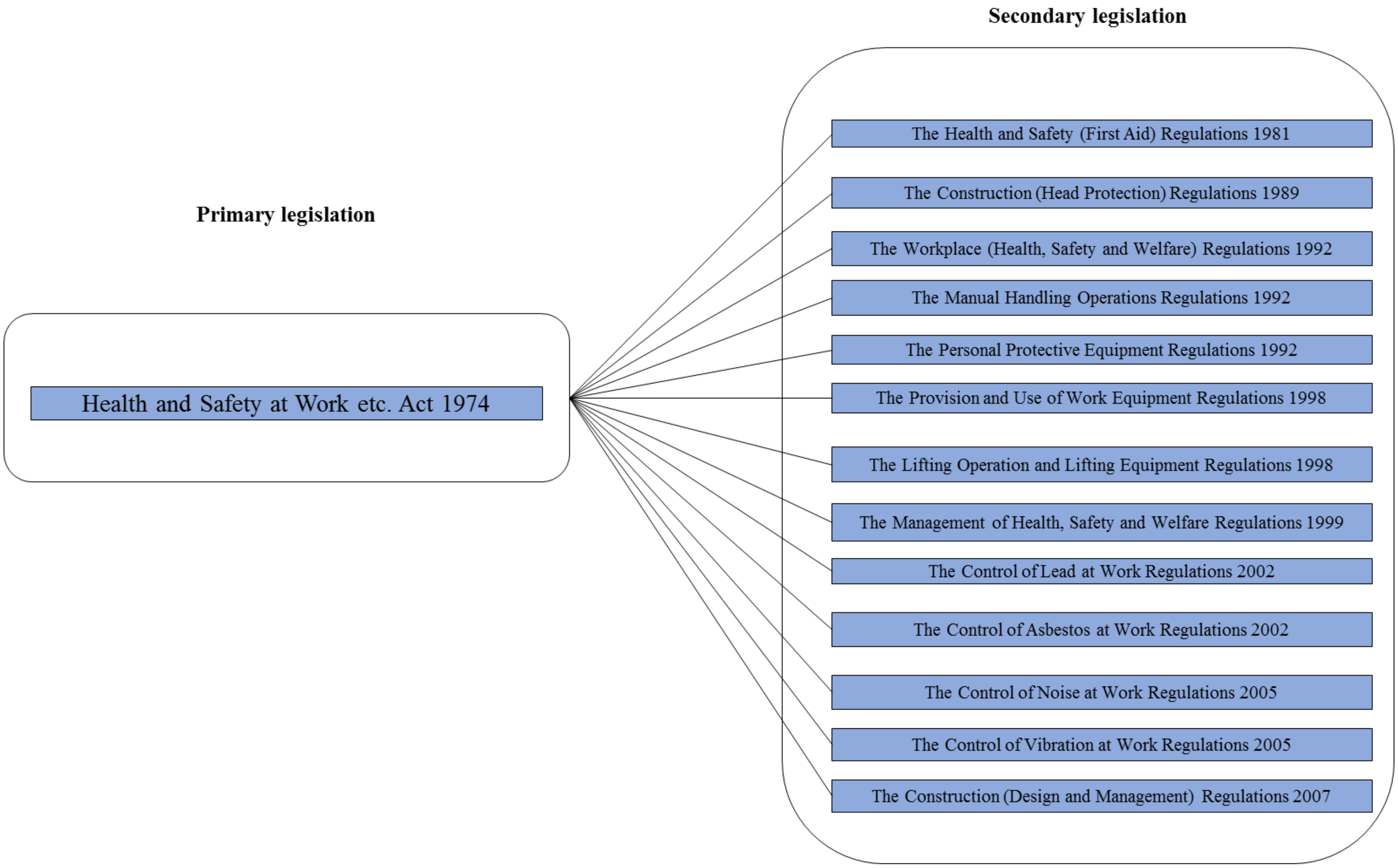

Figure 3.5: The relationship between the primary and secondary legislation (Adapted: Manu, 2012).

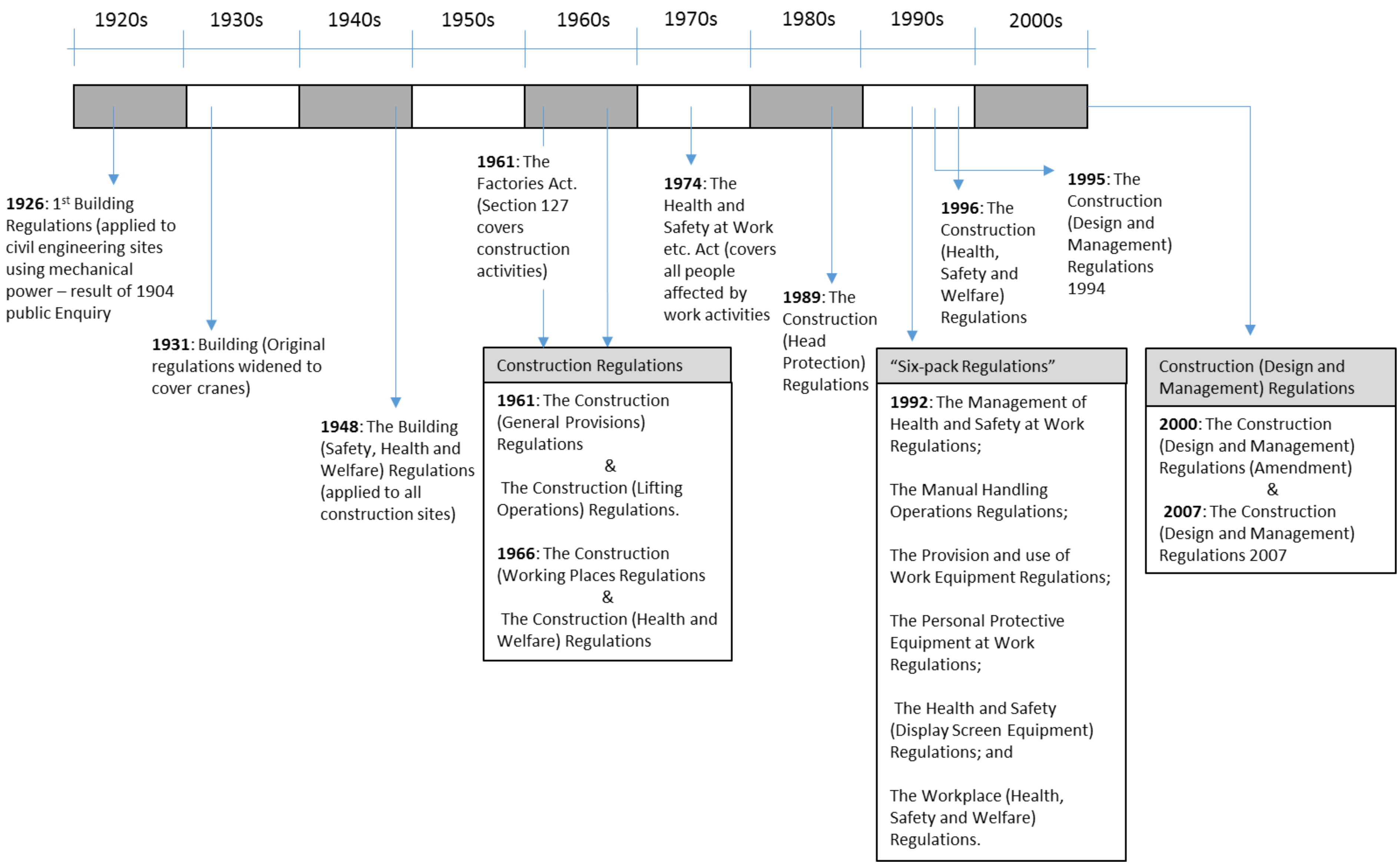

Figure 3.6: History of H&S legislation relevant to the construction industry (Adapted: Anderson, 1992; Phillips, 2006).

3.7 CHAPTER SUMMARY

This chapter identifies the origin of the UK H&S legislation and regulations particularly relevant to the construction industry. It also shows that application of the H&S legislation has evolved from a prescriptive style to a more flexible approach (self-regulating), suiting various industries, organisations and unique settings and systems of compliance. Notably, some of the subsidiary legislation is as a result of the European Directives; a process known as transposition (Metherall, 2010). The chapter also reveals that there is a wide variety of legislation applicable to H&S in the construction industry, further pointing out the main functions of the HSE in the context of enforcement. The subsequent chapter discusses the main provisions of the CDM Regulations and the EU Directives, thus establishes the degree of alignment.

CHAPTER 4: AN OUTLINE OF THE EU H&S DIRECTIVES AND THE CONSTRUCTION (DESIGN AND MANAGEMENT) REGULATIONS

4.0 INTRODUCTION

The preceding chapter establishes and determines the principles underpinning the H&S legal framework and its subsequent enforcement in the UK. Its primary focus was to identify the underlying principles behind the primary H&S legislation and explore the theories that underpin its enforcement. Drawing on insights from the previous chapter, Chapter 4 provides a detailed analysis of the main provisions contained within the EU H&S Directives and the CDM Regulations, thus meeting the third objective of the study. Management of risks inherent in construction activities is discussed briefly in Section 4.1. Sections 4.2 to 4.4 establish and determine the main provisions of the EU H&S Directives and the CDM Regulations. In Section 4.5, the main requirements in support of CDM implementation are discussed.

4.1 MANAGEMENT OF RISK AND CONSTRUCTION SAFETY

Management of risk in the construction industry has increasingly become an important element of project management of construction projects due to uncertainties and constraints associated with procurement processes and procedures, and work environment conditions (e.g. Carpenter, 2006a; Wells and Hawkins, 2011; Badri, *et al.*, 2012). These constraints are capable of acting as a catalyst towards the occurrence of accidents (Cheetham, 2000), hence the importance of their management. Indeed, management of risk, plays a pivotal role in workplace safety decision making (MacDonald, 2006). Even from a design perspective, it is widely acknowledged that risk can be designed out (Cameron *et al.*, 2007) (see also Section 2.2.2).

To this end, the importance of H&S management on any construction project cannot be overemphasised. Chileshe and Dzisi (2012) identified three most important benefits of H&S management, namely: (i) safer workplace, (ii) decrease in accidents, and (iii) enhanced company reputation. Although it is not the intention of this section to discuss management of risk in its entirety, an overview is provided which offers some insights. Previously, H&S was considered to be a secondary concern relative to other project performance indicators (PPIs) such as time, cost and quality as reported on numerous occasions (e.g. Smallwood *et al.*, 2005). However, such evidence has been challenged and it is of no surprise that further research into construction H&S management has been conducted. For example, Anderson (2003) explains that there are three areas that can enhance construction H&S, namely: academic research; construction industry practice; and insurance companies, while others still consider H&S management to be as equally important as other PPIs (e.g. Ng, *et al.*, 2005; Smallwood and Haupt, 2005). Arguably, the justification behind H&S as a project performance indicator is in its ability to include safety at the fore, thus protect workers and those around the construction site including members of the public.

According to Aires *et al.* (2010a), it is an immediate social priority and as such accident mitigation and the avoidance of risk are important considering that, if undealt with, they dent the image of the construction industry (cf. Rubio *et al.*, 2005). It is essential for the Client (as project promoter) and Contractors (as employers); including other key stakeholders to address this issue seriously (e.g. Anderson, 2011). It is often the case that a Client would want to be associated with an 'accident free' or 'zero accident' project given that they are regarded as the most influential party and the first link in the construction supply chain (e.g. Cheetham, 2000; Anderson, 2003). As such, considering accident mitigation and its occurrence is vitally important since high accident rates may not only cost the Client large sums of money (Cheetham, 2000), but may potentially damage the Clients' image and reputation (Baxendale and Jones, 2000). It is against this background that compliance with H&S legislation is beneficial. Rather than viewed as a burden, it is an important resource towards employer responsibility, to protect employees at places of work and improve working conditions.

In this regard, implementation of H&S legislation should be proportionate to the identified risk. Thereby providing a more structured approach to risk identification and assessment (e.g. Chapman, 2001). To reiterate the advice provided by Chapman, he espouses that: "project risk management (PRM) can provide a decisive competitive advantage to building sponsors." Such consideration regarding the perceived risk gap should be proportional to the effort required, resourcing requirements, or indeed, the level of importance placed on the prevailing risk. This view was established by MacDonald (2006), having undertaken detailed interviews with construction safety managers on small to medium sized projects. The connotation reached from the emerging model, was that risk judgement was invariably instinctive and instant (MacDonald, 2006, p.55), although influenced by a series of factors. As such, the identification of the risk, its analysis, and management are critical (Chapman, 2001). Bomel Limited (2006) developed a 'Global Risk Toolkit' to manage risk. It provides an indication of questions needed to be asked and how to address them; further identifying critical steps such as prioritising the risks and so forth. As such, it was in recognition of the 'high-risk' nature of the construction industry and its associated activities, the number of fatalities, injuries, and ill-health occurrences, that the Council of European Communities instructed the Commission to prepare Directives (also known as legislative instruments). Their aim is to improve H&S coordination in the construction industry (Antonio *et al.,* 2013). This decision led to the introduction and implementation of 'the minimum safety and health requirements at temporary or mobile construction sites'

(TMCS) EU Directive 92/57/EEC on the 24 June 1992 (Bishop, 1994). It is the eighth individual Directive under the Framework Directive 89/391/EEC as elaborated below.

4.2 THE COUNCIL DIRECTIVES

The Council Directives were introduced based on the mandate from the Council of European Communities (see EC Act 1972), also in compliance with the Treaty of Rome (Gibb *et al.*, 1999). Prior to the Directives, it is established that the European Foundation for the Improvement of Living and Working Conditions (1991) report, hugely influenced the Directives (Anderson, 2005). The Directives advocate for upstream consideration of workplace conditions to avoid accidents in construction.

Of key significance to the construction industry; particularly in the area of H&S management, is the Framework Directive (89/391/EEC) and the TMCS Directive (92/57/EEC) (Anderson, 2004; European Commission, 2011). The ethos behind the Framework Directive is to provide an obligation for prior assessment of occupational risks (Eurogip, 2007). Similarly, the purpose of the TMCS Directive is to improve coordination and management of H&S on construction sites from inception to completion and beyond (Bishop, 1994). To this end, reportage on their transposition into EU countries has been patchy. The Eurogip report is one such example that describes transposition of the Framework Directive. Similarly, a study conducted by Aires *et al.* (2010a) examined the transposition of the TMCS Directive in 15 EU member states and its impact on rate of accidents. Equally, this study found salient differences in the interpretation of the TMCS Directive particularly in the context of the UK H&S legislation; briefly discussed in this chapter, as well as in Chapter 8.

The following sections therefore provide a more comprehensive discussion on the main provisions of the Directives; their main features as well as how they relate to the construction industry; particularly considering the obligations of employers and workers.

4.2.1 The EU Directive 89/391/EEC (Framework Directive)

The Framework Directive was introduced on 12 June 1989 (see Article 19). It provides measures to encourage H&S improvements contained within nineteen articles, which describe actions to encourage such improvements in the safety and health of workers at work. According to Article 1(2), the provisions are based on the principles of:

> *...prevention of occupational risks, the protection of safety and health, the elimination of risk and accident factors, the informing, consultation, balanced participation in accordance with national laws and/or practices and training of workers and their representatives, as well as general guidelines for the implementation of the said principles.*

The Framework Directive contains principles that relate to risk prevention and elimination, while considering national laws, practices and training of workers or their superiors (Article 1(2)). It applies to all work sectors, although they are not applicable to certain public services such as police and armed forces or indeed the civil protection services. Table 4.1 describes the articles within the Framework Directive. Of the nineteen articles, seven articles relate to the employers obligations, while only two articles specify the obligations of workers. The remaining articles provide generic provisions. This Directive demonstrates that the employer has more responsibilities than that of workers, which perhaps signals the importance attached to the influence of a Client as an employer. Tables 4.2 and 4.3 describe the articles in detail, particularly those relating to the employers and the workers obligations.

Table 4.1: Framework Directive (EU Directive 89/391/EEC)

Article	Description of Article
Article 1	Object
Article 2	Scope
Article 3	Definitions
Article 4	Instruction to member states
Article 5	General provision
Article 6	General obligations on employers
Article 7	Protective and preventive services
Article 8	First, firefighting and excavation of workers, serious and imminent danger
Article 9	Various obligations on employers
Article 10	Worker information
Article 11	Consultation and participation of workers
Article 12	Training of workers
Article 13	Workers obligations
Article 14	Health Surveillance
Article 15	Risk groups
Article 16	Individual Directives – Amendments – General scope of this Directive
Article 17	Committee
Article 18	Final provisions
Article 19	Date of Directive

4.2.1.1 Obligations of Employers

It is the employer's duty to ensure that measures are put in place to protect workers from workplace risk (see Walters, 2006). Paragraph 1 under Article 6 states that employers are required to provide training and information towards prevention of risk. The risk prevention and elimination process will involve three stages of which four key questions need to be addressed (see Figure 4.1). In this way, fulfilling the employer's obligations and adhering to the law. Of course, during the process of risk elimination, there are other salient features such as cooperation (see Article 6(3), 6(4), 7(1), 11(1)); information provision (see Article 8(3), 8(4), 10(1), 10(2), 10(3)); and training (see Article 8(2), 12(1), 12(2)) which are critical.

Table 4.2: Obligations of Employers

Article	Description of Article
Article 6(1)	The employer is obliged to take the necessary measures the health and safety of workers including their protection, prevention of risk, information provision and training, and provide adequate resourcing
Article 6(2)	Elimination and evaluation of risk; adaption of work environment to suit individual workers based on the selected work equipment, methods of work so as to eliminate routine work which pause risk to health of workers; preplace dangerous work with non-dangerous or of less danger; develop a prevention policy which is clear in terms of technology, work organisation, conditions of work, social relationship issues and factors that influence the work environment; ensure collective protective

Article	Description of Article
	measures are of a higher priority than individual measures; provide suitable instructions to workers
Article 6(3)	Take account of the nature of the work within the establishment so as to evaluate risks to the safety and health of workers while also considering the selected work equipment, any chemical substances present and workplace fit-out; ensure preventative measures improve worker protection, be incorporated into other activities, ensure worker capabilities when delegating work, consult workers with regards to planning and introduction of new technologies; ensure that access to dangerous areas is available only to workers with adequate training
Article 6(4)	Cooperate with employees during the implementation and coordination of safety and health provisions, while paying attention to the nature of activities
Article 7(1)	Elect one or more workers to undertake activities related to protection and prevention of risks
Article 8(1)	Provide suitable measures for first aid, fire-fighting equipment, and removal of workers and make suitable arrangements when using external services for first aid, emergency and firefighting.
Article 8(2)	Ensure adequate workers are chosen and trained to implement measures for first-aid, fire-fighting and removal of workers
Article 8(3)	Inform workers at risk of exposure to serious danger and instantly remove them from the workplace to a safer place and avoid resumption of work if deemed unsuitable.
Article 8 (4)	Ensure workers in serious danger are in a position to take suitable steps even when a superior is not contactable
Article 9(1)	Be in a possession of workplace risk assessment; decide measures for protection considering the appropriate equipment; have a list of workplace accidents and draw up reports on workplace accidents
Article 10(1)	Provide suitable measures for workers or their representatives to receive all necessary information in undertaking their duties
Article 10(2)	Ensure adequate information is passed on to external employers for the protection of workers
Article 10(3)	Take suitable steps to ensure workers with specific duties have access to risk assessment and information for protection and prevention
Article 11(1)	Consult with workers in line with workplace safety and health
Article 11(5)	Allow workers with more responsibility to have time off work without forfeiting their pay
Article 12(1)	Provide adequate training for all workers in relation to their workspace
Article 12(2)	Ensure external workers receive adequate training regarding health and safety risks

Table 4.3: Obligations of Workers

Article	Description of Article
11(2)	Take part in any measures that affect safety and health, information provision
11(6)	Appeal to the safety and health authority for protection of workers in accordance with the law if measures undertaken are considered to be inadequate
13(1)	Ensure your own safety and health and other workers in accordance with the training and instructions received
13(2)	Ensure correct usage of various workplace machinery, equipment, tools and other devices; avoid sudden disconnection of such machinery; inform employers or workers of potential danger at the workplace due to inadequacies in protection arrangements; cooperate with the employer and other workers concerning workplace safety and health of workers; cooperate with the employer and other workers so as to allow the employer to provide a conducive work environment which poses no risk to safety and health of workers

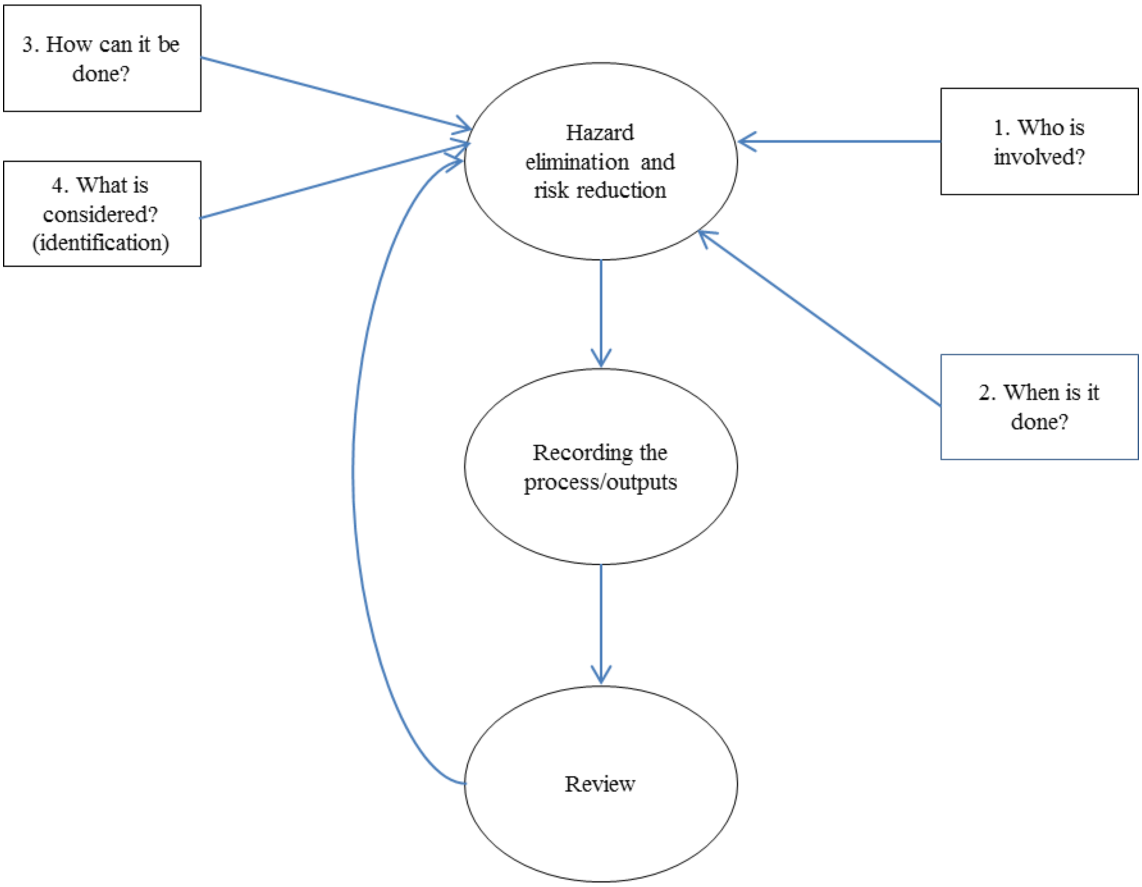

Figure 4.1: Risk elimination and reduction process (Source: CITB, 2007a)

4.2.1.2 Obligations of Workers

Workers on the other hand are expected to cooperate with the employer. Their role is that of participatory and must ensure that they are in possession of adequate information (Article 11(2)). In the event of inadequate safety and health information, Article 11(6), instructs workers to appeal such matters to the safety and health authority. Once the employer provides the training, workers will be required to ensure correct usage of machinery, equipment and other workplace equipment (Article 13(2)). As such, they are to ensure that the training and instructions provided are adhered to, in order to safeguard their own lives as well as those of their co-workers (Article 13(1)).

It is against this background and set of articles that the TMCS Directive relating to adoption of safety and health requirements on construction sites is formulated (see Article 16) (Eurogip, 2007), provisions of which are discussed below.

4.2.2 The EU Directive 92/57/EEC (TMCS Directive)

It is widely acknowledged that the TMCS Directive is aimed at improving the H&S performance of the construction industry within the context of the European Communities (e.g. Rubio *et al.*, 2005; Eurogip, 2007; Aires *et al.*, 2010b). In total, it comprises of fifteen articles as presented in Table 4.4. It applies to all construction work during the whole life cycle. However, it does not apply to the users of the constructed facility (European Commission, 2011). The Directive specifies requirements for the appointment of coordinators during the project preparation stage and the project execution stage (Articles 3, 4), as such considers two distinct stages of the construction process (cf. Rubio *et. al.*, 2005; Aires *et al.*, 2010b).

Various studies have indicated the benefits of early decision making before the execution stage. For example, a study conducted by the EU during the preparatory phase of the TMCS Directive, revealed that 60% of construction accidents were caused by decisions made before the actual work (i.e. upstream) (Rubio, *et al.*, 2005). Concisely argued, there is potential to address workplace risks during the early stages of a project before execution. Other provisions in the TMCS Directive include duties of the coordinators (Articles 5 and 6) and duties of other parties (e.g. clients, project supervisors, employers and other groups of persons) (see Articles 7, 8, 9 and 10)). The foregoing paragraph suggests that indeed the preparation stage of a project in terms of risk elimination and its management is critical. Given this view, it can be argued that obligations discharged upstream (i.e. during the initial implementation stage of the TMCS Directive) are critical. It is against this background that only Articles 3 to 6 are discussed below to highlight this key principle, however other provisions are discussed in Chapter 8 in support of the developed framework.

Table 4.4: TMCS Directive (EU Directive 92/57/EEC)

Article	Description of Article
Article 1	Subject
Article 2	Definitions
Article 3	Appointment of coordinators-safety and health plan – prior notice
Article 4	Project preparation stage: general principles
Article 5	Project preparation stage: duties of coordinators
Article 6	Project execution stage: duties of coordinators
Article 7	Responsibilities of clients, project supervisors and employees
Article 8	Implementation of Article 6 Directive 89/391/EEC
Article 9	Obligations of employers
Article 10	Obligations of other groups of persons
Article 11	Information for workers
Article 12	Consultation and participation of workers
Article 13	Amendment of the Annexes
Article 14	Final provisions
Article 15	Date of Directive

4.2.2.1 Appointment of coordinators, H&S plan and notice (Article 3)

Under Article 3 of the TMCS Directive, the Client or project supervisor has the mandate of appointing two coordinators for coordination of H&S matters, spanning between the project preparation and project execution stages. The coordinators are expected to coordinate the implementation of general principles of prevention in accordance with Articles 5 and 6. The manner in which this has been transposed by member states is different (Aires *et al.*, 2010a). For example, under the CDM 2007, the Client appoints the CDM-C and PC (Regulation 14) in the context of the UK construction industry. The non-binding report prepared by the European Commission (2011) clarifies this issue and states that:

> *There are two coordinator functions for safety and health matters for a project: one for the project preparation stage and one for the project execution stage. One person (natural or legal) can be appointed to fulfil both functions.*

Further, the Client or project supervisor must ensure that safety and health plan is developed as stipulated in Article 5(b). In addition, it is also the duty of the Client or the project supervisor to give prior notice (Article 3(3)). This is undertaken on the basis that the volume of work of a project exceeds 30 working days, 500 person-days or employs over 20 workers. Whereas, under the CDM 2007, it is the CDM-C's responsibility to ensure notice is given where a project exceeds 500 person days or 30 days. Indeed, this demonstrates some of the salient differences and shows that there is need for adequate time devoted to appointments, developing the H&S plan and giving prior notice to the relevant authority.

4.2.2.2 Project preparation stage: general principles (Article 4)

During this stage, the Client or project supervisor has to ensure that principles relating to risk prevention and elimination as established in the Framework Directive are adhered to (refer to Table 4.2). As such, issues to do with design decisions are of critical importance in planning procedures (see Article 4). Chapman (2001) provides a detailed description of the design process in which four main components are identified as illustrated in Figure 4.2 in a sequential manner.

When considering the selection of a team, qualities such as experience and training are of great importance. At the same time, specific design targets are critical for planning purposes. Furthermore, in line with Article 4, it is important to estimate resource requirements for completion of planned work stages (e.g. allocation of time and designed in risk management).

4.2.2.3 Duties of the coordinator: project preparation stage (Article 5)

It is the duty of the coordinator to coordinate risk prevention and elimination during the project preparation stage, as highlighted in the preceding section. Other obligations include: (i) preparation of the H&S plan, taking into account sets of rules applicable to the construction site; and (ii) putting in place appropriate measures for work involving particular risks to workers on site (e.g. falling from height, underground earthworks, handling of heavy prefabricated components and the like) (see Article 5(b) and Table 4.5)).

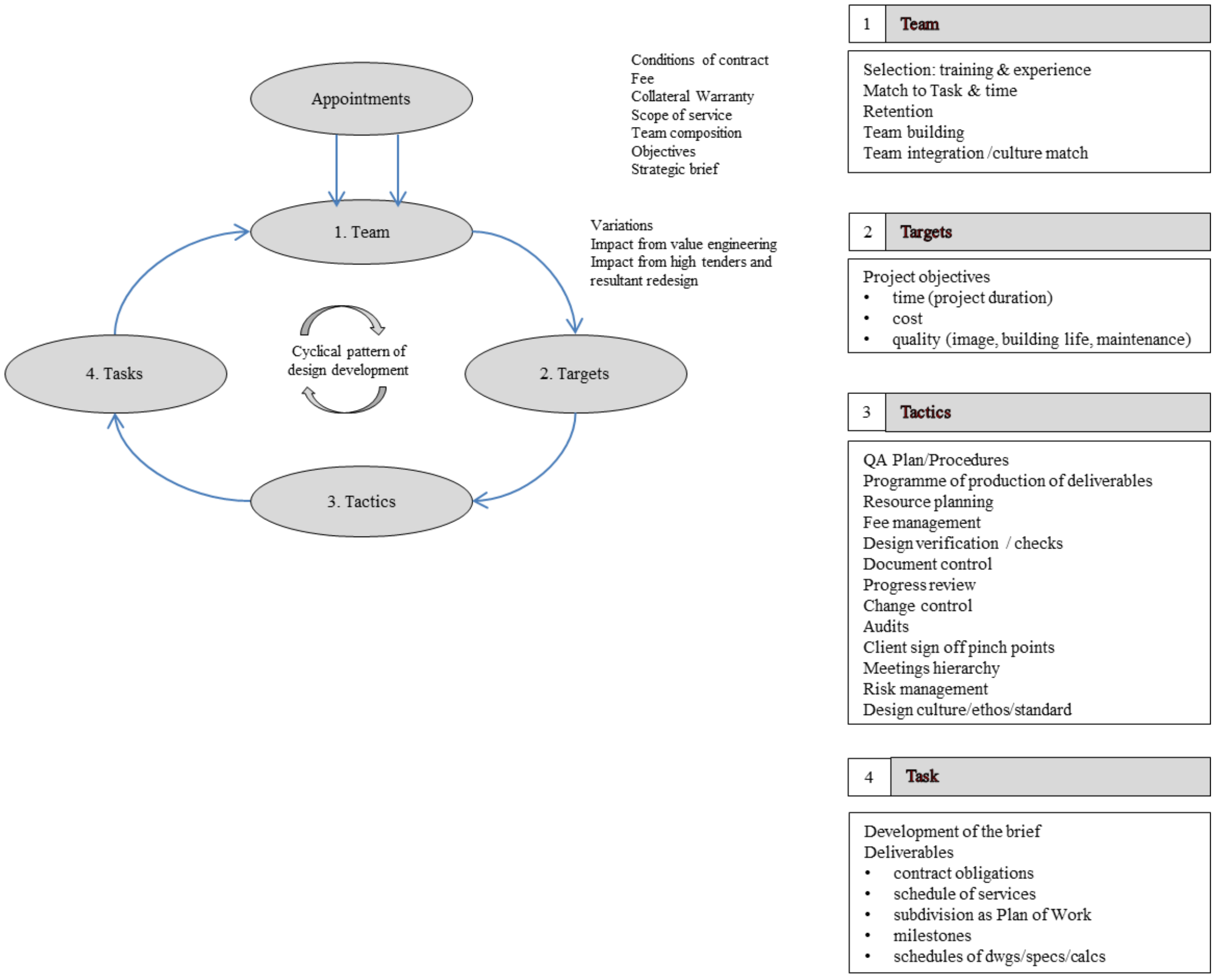

Figure 4.2: Components of the design process (Source: Chapman, 2001)

Furthermore, preparation of the H&S File comprising of project specific information relating to H&S intended for subsequent work is another duty of the coordinator that requires the input of other stakeholders.

Table 4.5: Duties of the coordinator during the project preparation stage

Article	Description of Article
Article 5(a)	Coordination of the principles of risk prevention and elimination
Article 5(b)	Preparation of the H&S plan
Article 5(c)	Preparation of the H&S file

4.2.2.4 Duties of the coordinator: project execution stage (Article 6)

Article 6(a) and 6(b), provides that the coordinator is to manage the whole life cycle of H&S, including implementation of general principles of prevention. Not only should the coordinator coordinate H&S matters on site, they are also encouraged to facilitate cooperation between employers and workers. It is the duty of the coordinator to ensure that the H&S Plan and H&S File are updated and reviewed accordingly during the construction phase (Article 6(c)). Given that the project preparation coordinator prepares the H&S Plan and H&S file (see Articles 5(b) and 5(c)), this inevitably demands facilitation of proper coordination and cooperation between the employers and workers (Articles 6(d) and 6(e)). Table 4.6 provides a list of duties performed by the coordinator during the project execution stage.

Table 4.6: Duties of the coordinator during the project execution stage

Article	Description of Article
Article 6(a)	Coordination of the principles of risk prevention and elimination including the planning of various work stages
Article 6(b)	Ensure employers comply with their duties for the protection of workers according to provisions under the Directive 89/392/EEC consistently
Article 6(c)	Review and update the H&S plan and the H&S file
Article 6(d)	Facilitate coordination and cooperation between employers, including subsequent employers on the same site and pass on information regarding occupational safety and health risks
Article 6(e)	Coordination of work place arrangements in an appropriate manner
Article 6(f)	Take appropriate action to ensure only authorised persons have access to the construction site

Having considered some of the provisions within the TMCS Directive, it can be observed that they specify detailed and specific obligations on various stakeholders. The premise behind the Directive is the ‘shared responsibility approach’, which was earlier established in the Robens report (see Section 3.1.1). It is against such an ethos that the CDM Regulations are developed. They place specific duties on various duty holders and transpose the requirements of the TMCS Directive as illustrated in Figure 4.3 and the subsequent sections.

4.3 THE CDM REGULATIONS 1994 (CDM 1994)

As a member state of the European Union, the United Kingdom (UK) Government seized the opportunity and responded to TMCS Directive by introducing the CDM 1994. It was a requirement for member states to transpose the Directive into their local legislation by 31 December 1993 (see Article 14, paragraph 1). Surprisingly, the transposition of the TMCS Directive into national laws by member states ranged from 1994 to 1999 (Aires *et al.*, 2010a). For example in Spain, the transposition of the TMCS into national law was in 1997 (Rubio *et al.*, 2005; Aires *et al.*, 2010a), two years after the UK. However, despite such delay and longer transposition time, Rubio *et al.* (2005) argue that in the context of Spain, the regulations were still ineffective towards safety improvement due to application problems associated with (a) coordination of H&S matters; (b) preparation of the H&S Plan; and (c) lack of appropriate training and cooperation with workers.

Similarly, in the UK, it became evident during the consultation process and period leading up to the introduction of the CDM 1994 that practical aspects involving their implementation were a source of concern. According to Bishop (1994), the majority of the respondents were in agreement with the regulations, while only a small minority rejected them on the basis that workers were solely responsible for their own H&S and not their employer (Bishop, 1994, p.366). The findings of the same study by Bishop (1994) suggest that in order to make the new-draft regulations implementable at the time, it was considered important to develop practice guidance notes, provide relevant information and training, and CPDs. Further, it was recommended that the HSE should provide guidance based on project types/categories, while illustrating the scope and detail of the H&S Plan and H&S File.

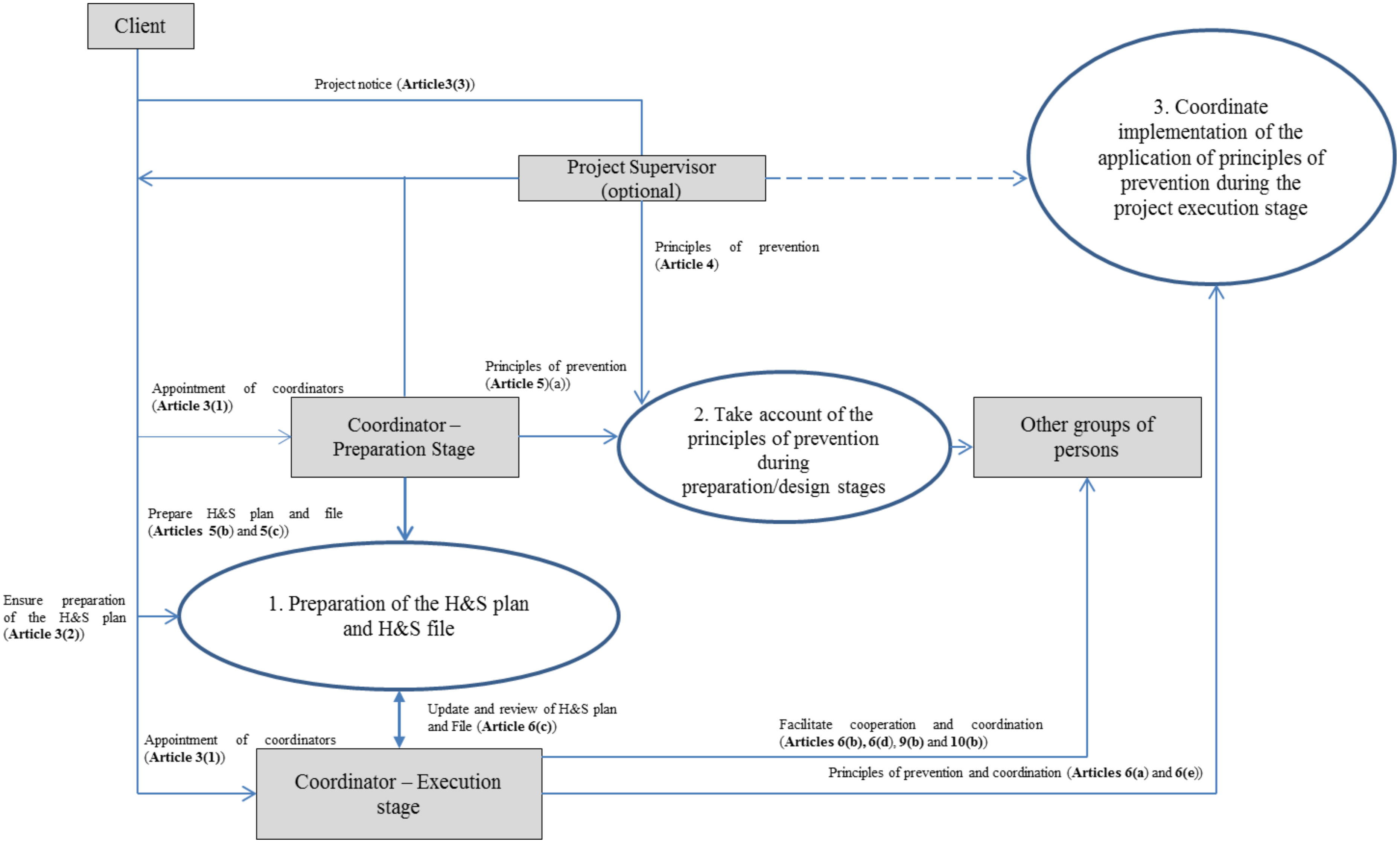

Figure 4.3: TMCS Directive 92/57/EEC (Adapted: CIC H&S Committee, 2012)

It appears that even before the actual implementation of the CDM Regulations, there were 'teething problems' because of the considerable amount of doubt and uncertainty in terms of their practicality (e.g. Bomel Limited, 2007). However, these concerns did not hinder the introduction of the CDM 1994. Thus, on 31 March 1995, the CDM 1994 came into force in the UK construction industry as law. According to Baxendale and Jones (2000), the main ethos behind their introduction were to:

(i) methodically consider safety, stage by stage from inception;

(ii) ensure that all parties contribute to H&S performance;

(iii) consider the undertaking of proper planning and coordination;

(iv) communicate and share information between parties; and

(v) make sure that a formal record of safety was developed for the future.

As such, in order to achieve the above, it was the Client's onus to establish the team, hence discharging key duties. For example, the Client was required to appoint the Planning Supervisor (PS) as early as was feasibly possible. The CDM 1994 were the transposition of the TMCS Directive into UK law and were considered as secondary legislation as illustrated in Figure 4.4. The main provisions of the CDM 1994 are discussed in detail in the next section.

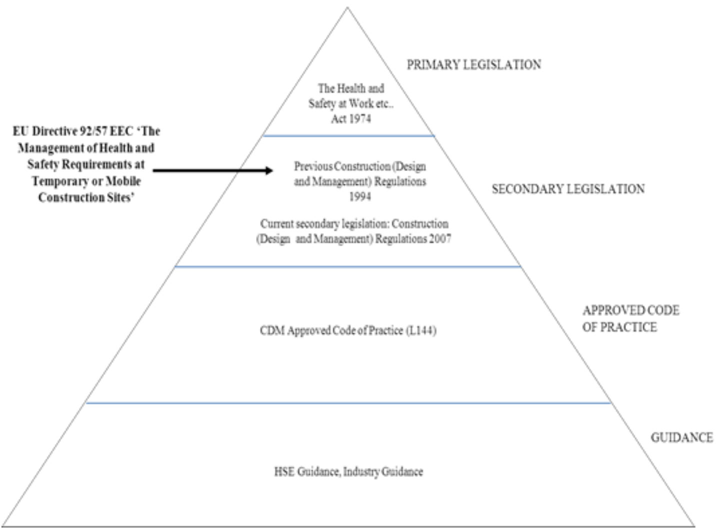

Figure 4.4: The primary and secondary H&S legislation (Source: Griffiths and Griffiths, 2011)

4.3.1 Main provisions of the CDM 1994 and duty holder responsibilities

The CDM 1994 comprised of 24 regulations specifying duties and requirements relating to improving H&S in the construction industry. They applied to construction work (Regulation 3(1)) and were not fully applicable to non-notifiable projects. Furthermore, it is worth acknowledging that there were five duty holders given the mandate to comply with the CDM 1994; namely, the Client, PS, Designer, PC, and Contractor of which the PS and the PC were new roles beyond the traditional or conventional construction parties. The regulations also specified the preparation of key documentation—that is, the (i) H&S Plan; and the (ii) H&S File in compliance with Regulations 12 and 15. Table 4.7 provides a description of the provisions in the CDM 1994.

Table 4.7: The Construction (Design and Management) Regulations 1994

Regulation(s)	Description of Regulations
1	Citation and commencement
2(1), 2(2), 2(3), 2(4), 2(5), 2(6)	Interpretation
3(1), 3(2), 3(3), 3(4), 3(5), 3(6),	Application of regulations
3(7), 3(8)	Clients and agents of clients
4(1), 4(2), 4(3), 4(4), 4(5), 4(6)	Requirements on developer
5(1), 5(2)	Appointment of Planning Supervisor and Principal Contractor [Client]
6(1), 6(2), 6(3), 6(4), 6(5), 6(6)	Notification of project [Planning Supervisor]
	Competence of planning supervisor, designer and contractors
7(1), 7(2), 7(3), 7(4), 7(5), 7(6)	Provision for health and safety
8(1), 8(2), 8(3), 8(4)	Start of construction phase
	Client to ensure information is available
9(1), 9(2), 9(3)	Client to ensure health and safety file is available for inspection
10	Requirements on designer
11(1), 11(2)	Requirements on planning supervisor
12(1), 12(2)	Requirements relating to health and safety plan [Principal Contractor]
	Requirements and powers of Principal Contractor
13(1), 13(2), 13(3)	Information and training [Principal Contractor]
14	Advice from, and views of, persons at work
15(1), 15(2), 15(3), 15(4), 15(5)	Requirements and prohibitions on contractors
16(1), 16(2), 16(3)	Extension outside Great Britain
17(1), 17(2), 18	Exclusion of civil liability
19(1), 19(2), 19(3), 19(4),	Enforcement
19(5), 20, 21, 22, 23	Transitional provisions
24(1), 24(2), 24(3), 24(4)	Repeals, revocations and modification (Regulations 16 – 24)

4.3.1.1 Duties of the Client (or Clients' agent)

According to Regulation 4(1), the Client had the responsibility of appointing a Clients' agent or another client. It stated that; "A client may appoint an agent or another client to act as the client in respect of a project […]." The intention was for the agent to act and discharge duties on the Clients' behalf. The Client (or project initiator) was accountable for duties in relation to competence assessment of appointed duty holders (Regulation 4(2)); preparing a declaration in writing (Regulation 4(3) and 4(4)); and where such a declaration is received, the notified authority was required to give notice to the Client (or Clients' agent).

Further, under Regulation 6(1), it was the Client's duty to appoint the PS (Regulation 6(3)) and the PC (Regulation 6(4)). Additionally, before such appointments, the competences of the appointees were to be considered (see Regulation 8). Regarding the appointment of the PC, the regulations stated that only a contractor was obliged to be appointed as PC (see Regulation 6(2)). However, under the CDM 2007, any person (or organisation) qualifies to be appointed as the PC (see Regulation 14(2)). Given that the onus is on the Client to establish a competent team with adequate resourcing, it demonstrates that they are instrumental in paving the way forward, as such central to CDM implementation (e.g. Baxendale and Jones, 2000). Further, under the CDM 1994, it was possible for the Client to take up the role of PS or PC according to Regulation 6(6)(b). After such appointments, the Client was to ensure that adequate information was provided (Regulation 11) and notice given to the HSE (Regulation 7).

Additionally, the Client was responsible for taking appropriate H&S measures and steps towards worker protection. Regulation 9(1) explains that the Client was required to assess the suitability of the appointed person in the roles of PS, Designer, and Contractor, mostly based on sufficiency of resources. The Client was then required to ensure that the H&S Plan was prepared (see Regulations 10 and 15(4)); and provide adequate information to the PS (Regulation 11). At the end of the construction phase, it was the Client's responsibility to ensure that the H&S File was available for inspection (Regulation 12).

4.3.1.2 Duties of the Planning Supervisor (PS)

The PS had the responsibility to ensure that notice of the project was given to the HSE in writing (Regulation 7(1)) in accordance with Regulation 7(2) to 7(4). Further, according to Regulation 14, the PS was mandated to take reasonable steps to ensure that the design adequately took into consideration risks to the H&S of any person working on site. In addition, it was the duty of the PS to ensure that the H&S File was prepared within the specified timeframe (see Regulation 15(1)) and updated accordingly (Regulation 14(e)). In practice, this role was either executed by an independently appointed PS or by an in-house team member (Griffith and Phillips, 2001).

4.3.1.3 Duties of the Designer under the CDM 1994

The Designer had the responsibility to design out foreseeable risks according to Regulation 13(2)(a). The designs were required to contain adequate information about various aspects of the project, which had the potential to affect the H&S of persons working on the site (Regulation 13(2)(b)).

During the execution of the Designer's duties, it was incumbent upon this duty holder to maintain cooperation with the PS and other Designers preparing designs in connection with the same project (see Regulation 13(2)(c)). This issue of cooperation is clearly expressed by the exchange of information. In light of this, Mulholland *et al.* (2005) identified areas that needed improving regarding information provision. It was therefore imperative that the

Designer was aware of H&S regulations; implications of their design, by being familiar with the relevant H&S legislation provisions; preparing appropriate risk assessments; and becoming more familiar with the actual procedures that translated into their designs or indeed becoming aware of the design implications from an H&S point of view.

4.3.1.4 Duties of the Principal Contractor (PC) under the CDM 1994

Regulation 15(4) stipulated that the PC was required to ensure adherence with the H&S Plan until the end of the construction phase. The other main duties of this duty holder were to:

(i) ensure cooperation between all contractors (Regulation 16(1)(a));

(ii) encourage compliance with the rules set out in the H&S plan (Regulation 16(1)(b));

(iii) take appropriate action to ensure that only authorised persons are allowed on site (Regulation 16(1)(c));

(iv) display particulars contained in the notice in accordance with Regulation 7 (Regulation 16(1)(d)); and

(v) provide the PS with information relevant to development of the H&S file (Regulation 16(1)(e)) (as soon as was practicable).

Where applicable, the PC was also required to direct contractors to enhance their compliance with the regulations (see Regulation 16(2)). As such, it required the PC to provide information and training to other contractors and their employees (Regulation 17).

4.3.1.5 Duties of the Contractor under the CDM 1994

Every Contractor was required to cooperate with the PC according to Regulation 19(1). It was also expected of the Contractor to provide information to the PC and comply with any instructions given. Furthermore, the Contractor was required to comply with the provisions of the H&S Plan (Regulation 15) and ensure that only those authorised to work on the construction site were permitted to do so (Regulation 19(2)).

4.3.2 Challenges associated with the CDM 1994 in practice

The CDM 1994 spurred a number of concerns regarding their implementation in practice. Baxendale and Jones (2000) point out a number of shortcomings such as the preparation of the Construction Phase Plan (CPP); undertaking of dual roles; slow response of Designers to design out risk (cf. CDM Task Group, 1998); and timing of appointments. Beal (2003) on the other hand argued that the accompanying ACoP was confusing and of limited use.

Equally, a study conducted by Griffith and Phillips (2001), revealed a number of shortcomings relating to the implementation of these regulations such as:

(i) a lack of understanding of the regulations to an extent that most duty holders were not conversant with their application;

(ii) specific exclusions in the regulations creating considerable ambiguity;

(iii) a lack of technical detail, education and training, and induction towards application of the regulations; and

(iv) a lack of the wider vision leading to better practice.

Indeed, even the shortcoming concerning lack of understanding of the regulations was also expressed by Gibb *et al.* (2006). In their study, it was identified that Designers were still failing to address the safety implications of their design and specifications (cf. Bomel Ltd, 2007). These findings reinforce the need for further empirically based research into identifying practices regarding the discharge of duties of the Designer and the implications of such practices.

A study conducted by Bomel Ltd (2007) based on 25 structured interviews revealed the following deficiencies:

- lack of duty holder responsibility/awareness;
- non-effectiveness of the PS role;
- risk transfer and self-protection because of industry practice;
- excessive paperwork leading to bureaucracy;
- lack of clarity;
- lack of risk management improvement through design; and
- lack of compliance with CDM documentation preparation.

Whilst most the research previously conducted has been based on empirical findings from interviews and questionnaires, Cheetham (2000) examined prosecutions between the periods 1996/97 and 1998/99. This study showed that the Client was prosecuted largely because of the failure to appoint the PS (Regulation 6), while the other reason was the lack of awareness of materials used in the fabric of the building (particularly the presence of asbestos, Regulation 11).

Whereas, Howarth *et al.* (2000) recognised that the practical implementation of the CDM Regulations increased the time taken for preparation of tender documentation. Additionally, appointments, notification to the HSE and preparation of the H&S Plan and the H&S File were also considered to have had an impact on increased workload by the concerned duty holders. For example, conclusions drawn from the Client sample suggests that there were additional time implications because of appointing the PS. The role itself was a source of concern as already mentioned previously (see The Consultancy Company, 1997).

Mulholland *et al.* (2005) on the other hand conducted a study investigating communication and information exchange amongst CDM duty holders. Their findings suggest that the CDM Regulations generally raised the awareness of H&S and that the Client was instrumental in setting the tone for a positive H&S culture. This study was conducted across the UK construction industry using a mixed methods approach comprising of: focus groups, questionnaires, and follow-up interviews. It revealed significant problems with "quality, quantity, and effectiveness of communication and information exchange amongst and between duty holders". Specific weaknesses outlined by Mulholland *et al.* (2005) associated with the CDM 1994 included:

- excessive time spent on producing irrelevant paperwork departing from the regulation requirements;
- insufficient action taken to implement effective H&S processes;
- insufficient understanding of basic risk assessment processes amongst some duty holders;
- inaccurate assessment of competency of appointed duty holders; and
- insufficient H&S training provided to some duty holders and site operatives.

It is these concerns from various stakeholders across the industry that triggered the need to revise the CDM Regulations 1994.

4.3.3 Revision of the CDM Regulations 1994

Given the widespread concerns raised against the CDM 1994, it became evident that there was need to address the situation and because of this, a decision was reached to revise the CDM 1994 (HSE, 2001). However, prior to the introduction of the CDM Regulations 2007 (CDM 2007), the CDM 1994 were amended which resulted in the introduction of the CDM Regulations 2000. Details of the amendments were as follows:

1) The definition of the 'designer' was substituted in Regulation(2) to mean "any person who carries on a trade, business or other undertaking in connection with which he prepares a design." A new paragraph (3A) was inserted after paragraph 3 of Regulation 2. It stated, "Any reference in these Regulations to a person preparing a design shall include a reference to his employee or other person at work under his control preparing it for him; but nothing in this paragraph shall be taken to affect the application of paragraph (2)".
2) Regulation 12 was rephrased by deleting the words "the property of" which appeared twice in Paragraph 2; and
3) Regulation 13 was rephrased by inserting the words "for him", after the word "prepare", where it first occurred.

Following this decision, in September 2002 a discussion document was published by HSE to highlight the performance of the industry in line with H&S. Subsequently, the HSE further published a consultation document (CD) on 31 March 2005, which contained the draft regulations as well as the draft guidance (Bomel, 2007). Bomel Limited (2007) established the main overarching motivation behind the revision of the CDM 1994 towards improved risk management on construction sites—i.e., to:

(i) simplify the regulations in order to clarify duty holder responsibilities;

(ii) enable flexibility of the CDM Regulations for easy of fitting into various contractual arrangements;

(iii) emphasise the planning and management rather than the associated paperwork such as the H&S Plan; and

(iv) simplify the competence assessment procedures.

Furthermore, there was considerable debate regarding the proposed changes to the CDM 1994. One such issue was the role of 'coordinator'. It was envisaged that, because the coordinator had no powers to give directions despite the number of responsibilities, the effectiveness of the role was questionable (Anderson, 2005). However, despite these uncertainties raised even before the introduction of the new regulations, plans went ahead to replace the "Planning Supervisor" (PS) role, with that of the "CDM Coordinator" (CDM-C). Additionally, explicit duties of the Client were introduced, previously performed by the Clients' agent. Other measures introduced, applicable to all duty holders included competence checks (Regulation 4); cooperation (Regulation 5); coordination (Regulation 6); and general principles of prevention (Regulation 7) (Rabin, 2007).

4.4 THE CDM REGULATIONS 2007 (CDM 2007)

The CDM 2007 came into force on 6 April 2007 (Regulation 1). Also known as Statutory Instruments 2007 No. 320, these regulations apply to all construction work within the UK and guidance relating to their application is contained in the Approved Code of Practice—L144 (ACoP). Key parties involved during conception, design, planning, construction, maintenance, and demolition have specific duties to discharge in compliance with the CDM 2007 (see e.g. Williams, 2007).

Once established that a project is notifiable (i.e. lasting over 30 days or involving 500 person days) to the HSE or the Office of Rail Regulation (ORR), it is the duty of the CDM-C to ensure that such notice is given (Regulation 21(1)). However, before discharging this duty, the Client has the responsibility of appointing the CDM-C (a role previously known as PS under CDM 1994) (see Section 4.3.1.2). In circumstances were the Client does not make such an appointment, it is considered that the Client assumes the role of CDM-C (see Regulation 14(4)(a)).

After the appointment of the CDM-C, it is the duty of the Client to appoint a PC, preferably, when there is enough information on the project (Regulation 14(2)). Figure 4.5 illustrates how to determine when a project is notifiable, implying that the regulations and the roles of CDM-C and PC fully apply until the end of the construction phase (see Regulation 14(3)). On the other hand, when a project is non-notifiable, the Client need not appoint the CDM-C or PC. However, duties of the Client, Designer and Contractors still apply to the respective parties as reiterated by Perry (2010) in her article titled "One CDM fits all" (see Table 4.8 for a full list of the CDM 2007 provisions). Thus, implementation of the CDM 2007 requires the Client to establish a competent team with the prime intention of complying with the intended provisions of the CDM 2007.

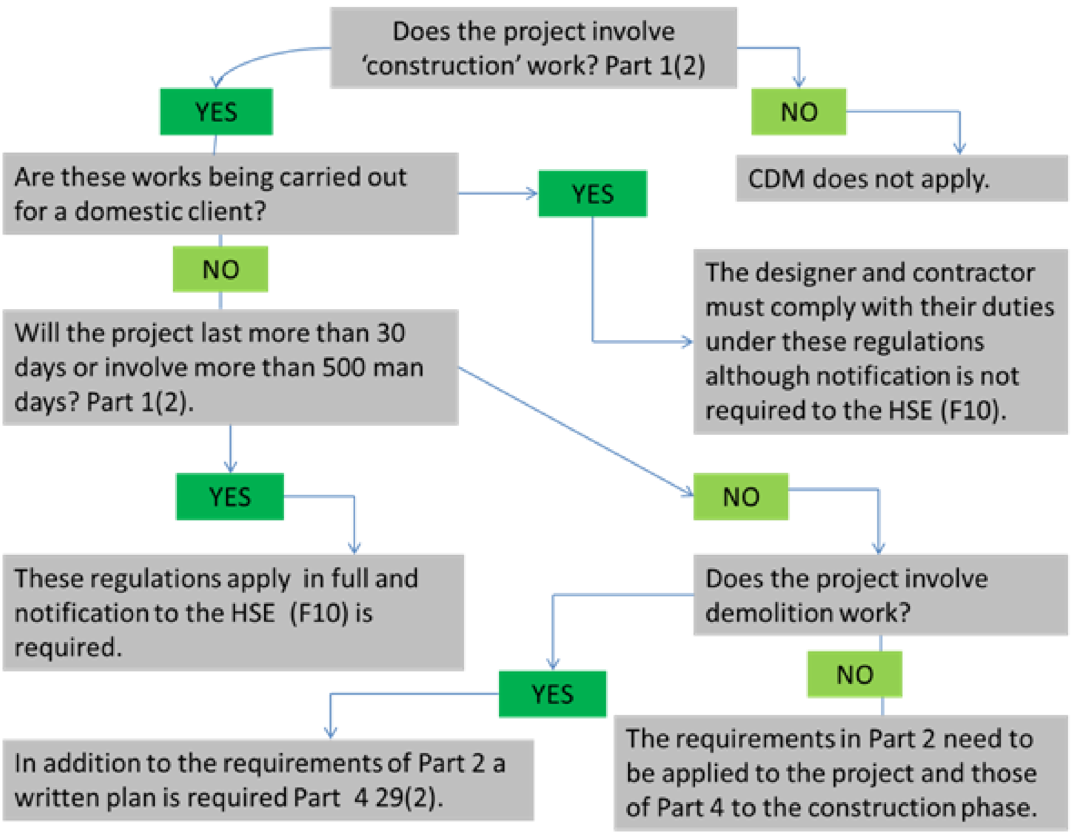

Figure 4.5: Application of the CDM Regulations 2007 (Adapted: Pye Tait Consulting, 2010)

Table 4.8: The Construction (Design and Management) Regulations 2007

Regulation(s)	**Description of Regulations**
1	Citation and commencement
2(1), 2(2), 2(3)	Interpretation
3(1), 3(2), 3(3), 3(4), 3(5)	Application
4(1), 4(2)	Competence
5(1), 5(2)	Cooperation
6	Coordination
7(1), 7(2)	General principles of prevention
8	Election by clients
9(1), 9(2)	Client's duty in relation to arrangements for managing projects
10(1), 10(2), 10(3)	Clients duty in relation to information
11(1), 11(2), 11(3), 11(4), 11(5), 11(6)	Duties of Designers
12	Designs prepared or modified outside Great Britain
13(1), 13(2), 13(3), 13(4), 13(5), 13(6), 13(7)	Duties of contractors
14(1), 14(2), 14(3), 14(4), 14(5)	Appointments by the client where a project is notifiable
15	Clients duty in relation to information where a project is notifiable
16	The clients duty in relation to the start of the construction phase where a project is notifiable
17(1), 17(2), 17(3), 17(4)	The clients duty in relation to the health and safety file
18(1), 18(2)	Additional duties of Designers
19(1), 19(2), 19(3)	Additional duties of contractors
20(1), 20(2)	General duties of CDM Coordinators
21(1), 21(2), 21(3), 21(4)	Notification of project by the CDM Coordinator
22(1), 22(2)	Duties of the Principal Contractor
23(1), 23(2)	The Principal Contractor's duty in relation to the construction phase plan
24	The Principal Contractor's duty in relation to cooperation and consultation with workers
25 – 44	Duties relating to Health and Safety on Construction sites
45 – 48	General

4.4.1 Main provisions of the CDM 2007 and duty holder responsibilities

The CDM Regulations 2007 consists of five parts as listed below:

- Part 1: Introduction (Regulations 1-3);
- Part 2: General management duties applying to construction projects (Regulations 4-13);
- Part 3: Additional duties where a project is notifiable (Regulations 14-24);
- Part 4: Duties relating to H&S on construction sites (Regulations 25-44); and
- Part 5: General (Regulations 45-48).

The provisions under Part 2 apply to all persons, particularly those taking up specific roles in compliance with the regulations. The specific regulations in part 2 that apply to all persons include; Regulation 4 (Competence), Regulation 5 (Co-operation), Regulation 6 (Coordination), and Regulation 7 (General principles of prevention) as discussed below.

4.4.1.1 Regulation 4 (Competence)

Regulation 4 applies to all duty holders. It is required that they possess the appropriate level of competence (e.g. Regulation 4(1)(a)) and reciprocally should not accept such an appointment without the necessary competence (see Regulation 4(1)(b)). Because of this, it is expected of the appointee to discharge their duties in a competent manner. The ACoP under paragraph 195 qualifies the meaning of competence by identifying the following qualities of a competent organisation or individual:

(a) possessing appropriate knowledge of a particular task and its associated risks; and

(b) possessing appropriate experience from past projects and awareness of their limitations in order to take suitable remedial action.

Other studies (e.g. Bomel Ltd, 2007) seem to suggest that competence has a direct influence on construction H&S, although arguably, the factors that constitute competence differ. For example, Antonio *et al.* (2013) conclude that communication, negotiation, and commitment to the project, strengthen the job performance of a coordinator; signalling their competence.

4.4.1.2 Regulation 5 (Cooperation)

Regulation 5 stipulates that all persons (i.e. duty holders) are to cooperate with one another (see Regulations 5(1)(a) and 5(1)(b)). It is mainly applicable to projects undertaken on the same construction site or indeed an adjoining site. Where a person is working under the control of another person, they are required to report anything likely to pose a risk to their

H&S or that of their co-workers (Regulation 5(2)). Paragraph 44 of the ACoP suggests that cooperation is likely to take place when parties are appointed early, although in practice this is actually a key concern (see SEC, 2010). The origins of this provision are clearly traceable to Article 6(d) of the TMCS Directive and Article 6(4) of the Framework Directive.

4.4.1.3 Regulation 6 (Coordination)

Regulation 6 requires all persons concerned on the project to coordinate activities in a suitable manner, to ensure that the H&S of persons involved is taken into consideration; particularly those carrying out construction work (Regulation 6(a)) and those affected by such work (Regulation 6(b)). As such, appointment of the CDM-C is crucial to ensure the coordination of H&S arrangements and so forth.

4.4.1.4 Regulation 7 (General principles of prevention)

It is a requirement that every person on whom these regulations place duties relating to the design, planning and preparation of a project take into account the general principles of prevention during the execution of those duties at all times (Regulation 7(1)). Similarly, Regulation 7(2) instructs those undertaking duties during the construction phase to take account of the principles of prevention in a reasonably practicable manner. The general principles of prevention can be traced back to Article 6(2) of the Framework Directive as previously discussed in Section 4.2.1 and Table 4.2.

4.4.1.5 Duties of the Client

The Client is instrumental during the implementation of the CDM Regulations (e.g. CITB, 2007b). According to the Construction Industry Training Board, they provide the leadership required for CDM implementation. It is the Client's responsibility to ensure that parties appointed are competent and have enough resources to undertake and execute their duties. Recognising the central role played by the Client in CDM implementation is crucial for the overall project procurement strategy (Wells and Hawkins, 2011). Regulation 9(1) provides that, the Client must ensure that adequate time and resources are allocated during the initial phase of implementation of the CDM 2007. Paragraph 45 of the ACoP provides some advice and states that:

> *Unrealistic deadlines and a failure to allocate sufficient funds are two of the largest contributors to poor control of risk on site. When engaging designers and contractors, and for notifiable projects appointing CDM coordinators and principal contractors, clients have to consider the resources (for example staff, equipment and, particularly, time) needed to plan and do the work properly.*

There has been a consensus that most problems occur with one-off Clients rather than frequent Clients (e.g. Pye Tait Consulting, 2010). A report conducted by Pye Tait Consulting (2010) revealed that two-thirds of one-off Clients were oblivious of the CDM Regulations and often relied on the expertise of contractors. It is therefore of no surprise that the CITB provides guidance for small, one-off, and infrequent Clients (CITB, 2007b). The guidance introduces the CDM 2007, defines the Client in the context of the CDM 2007; and discusses compliance with duties of the Client.

In order for duty holders to comply with their CDM 2007 responsibilities, the Client must reciprocate by providing detailed pre-construction information prior to their appointment or during the initial stages of design. As such, it is the Client's responsibility to ensure that those appointed are competent enough to carry out their duties in compliance with Regulation 4. Table 4.9 outlines the duties of the Client under the CDM 2007.

Table 4.9: Duties of the Client (CDM 2007)

Regulation	Description of duties
9(1)	Ensure suitable arrangements are in place for managing the project without risk to the health and safety any person
9(2)	Maintain and review arrangements for managing the project without risk to the health and safety of any person
10(1)	Ensure preconstruction information is provided to the Designer and Contractor
10(2)	All relevant information on the project shall be passed on in accordance with Regulation 10(1)
10(3)	Ensure the health and safety of all people engaged or affected by construction work and assist those with duties under the Regulations
14(1)	Appoint the CDM Coordinator where a project is notifiable
14(2)	Appoint the Principal Contractor after the CDM Coordinator
14(3)	Ensure that such appointments are renewed until the end of the construction phase
14(4)	The client is responsible for the roles of CDM Coordinator and Principal Contractor where no such appointment has been made.
14(5)	Appointment shall be made in writing
15	Ensure all preconstruction and relevant information is passed on to the CDM Coordinator where a project is notifiable
16	Ensure that the Principal Contractor has prepared the construction phase plan before the start of the construction phase
17(1)	Ensure all health and safety information is passed on to the CDM Coordinator likely to be needed for inclusion in the Health and Safety File
17(2)	In circumstances where one health and Safety File relates to more than one project, ensure that such information is easily identifiable.
17(3)	Reasonable steps are to be taken to ensure that after the construction phase, information relating to health and safety file is available for inspection and revised appropriately
17(4)	Ensure that the health and safety file is passed on to the new client and its contents and use are known where the existing client disposes off his interest

4.4.1.6 Duties of the CDM Coordinator (CDM-C)

The CDM-C is appointed by the Client based on a project's eligibility for notification to the HSE, preferably during the initial design phase of the project. Regulation 14(1) explains that this duty needs to be fulfilled as soon as is reasonably practicable. Early appointment of the CDM-C is crucial for the Client, since it is the CDM-C's duty to advise the Client in performing his duties (Regulation 20(1)). However, even beyond the construction phase, CITB (2007c) explains that early appointment of the CDM-C benefits H&S as a whole; assists with feasibility studies; overall coordination of H&S on site; and generally helps the project team identify, eliminate, and avoid construction risks which are of an inherent nature.

As such, the Client becomes legally liable for the duties of the CDM-C in the event of breach of Regulation 14(1) as already established in Section 4.4. An example of the consequences for failure to appoint a CDM-C is cited in a case in which an independent school in Dorset fell short in their duties. They failed to carry out an asbestos survey, which led to dangerous exposure to asbestos fibres. It was concluded by the HSE (2012b) that:

> *The CDM coordinator would have ensured a full refurbishment and demolition asbestos survey was completed in advance of construction work. Licensed asbestos contractors could then have been appointed to safely remove it. Sherborne School pleaded guilty breaching Regulation 4(8) of the Control of Asbestos Regulations 2006 and Regulation 14 of the Construction (Design and Management) Regulations 2007 at a previous hearing before Weymouth Magistrates. The school was fined a total of £60,000 and ordered to pay £13,000 in costs.*

Additionally, in another case similarly breaching Regulation 20(2)(c), BAE Systems Properties Ltd was fined £8000. They assumed the role of CDM-C, however failed to "take reasonable steps to ensure that Designers comply with their duties under Regulations 11 and 18(2)" (Regulation 20(2)(c)). As such it was concluded that (HSE, 2010):

> *BAE Systems Properties Ltd as the client, failed to appoint a CDM Co-ordinator at the design stage of the project, between 9th Jan 2008 and 5th July 2008 as required under Reg. 14(1) CDM, thereby assuming these responsibilities by virtue of Reg 14(4)(a) and (b) CDM, but failed to comply with the requirement under Reg 20(2) CDM to avoid foreseeable risks to the health and safety of persons carrying out construction work.*

Table 4.10 provides a comprehensive list of the duties of the CDM-C under the CDM 2007.

Table 4.10: Duties of the CDM-C (CDM 2007)

Regulation	Description of duties
20(1)(a)	Give suitable advice and assistance to the client regarding compliance with the clients duties under the Regulations
20(1)(b)	Ensure that arrangements for coordination of health and safety measures during planning and preparation for the construction phase are implemented
20(1)(c)	Liaise with the Principal Contractor regarding information required for the preparation of the Construction Phase plan, contents of the Health and Safety File and any design development that may affect the planning and management of construction work
20(2)(a)	Take reasonable steps towards identifying and collecting pre-construction information
20(2)(b)	Promptly provide pre-construction information to all Designers, Contractors and the Principal Contractor
20(2)(c)	Take all reasonable steps to ensure Designers comply with their duties and provide sufficient

Regulation	Description of duties
	information about aspects of the design to assist other Designers, Clients, the CDM Coordinator, and Contractors
20(2)(d)	Take all reasonable steps during the construction phase to ensure cooperation between Designers and the Principal Contractor in relation to any design or design change
20(2)(e)	Prepare where none exists the Health and Safety File and update/review for subsequent construction work
20(2)(f)	Handover the Health and Safety File to the Client at the end of the construction phase
21	Ensure notice is given to the Health and Safety Executive (or Office of Rail Regulation)

Most importantly, the CDM-C is required to prepare the H&S File (Regulation 20(2)(e)) which is then passed on to the Client in accordance with Regulation 20(2)(f). If the H&S File already exists, the CDM-C must ensure that it is updated appropriately. Paragraph 263 of the ACoP suggests including the following information in the H&S File:

(i) description of the construction project undertaken;

(ii) description of residual hazards and strategy of how to address them;

(iii) structural elements of concern;

(iv) hazardous substances;

(v) description of strategy for removal or dismantling of plant;

(vi) list of equipment for use during cleaning and maintenance;

(vii) location of significant services, specialist equipment and hidden cabling; and

(viii) as-built drawings including means of access to services and other specialist areas.

In terms of their relationship with the Client, the CDM-C is mandated and required to be aware of the Clients' knowledge (Regulation 9(1)) and most importantly assist the Client accordingly (Regulation 20(1)) as illustrated in Figure 4.6.

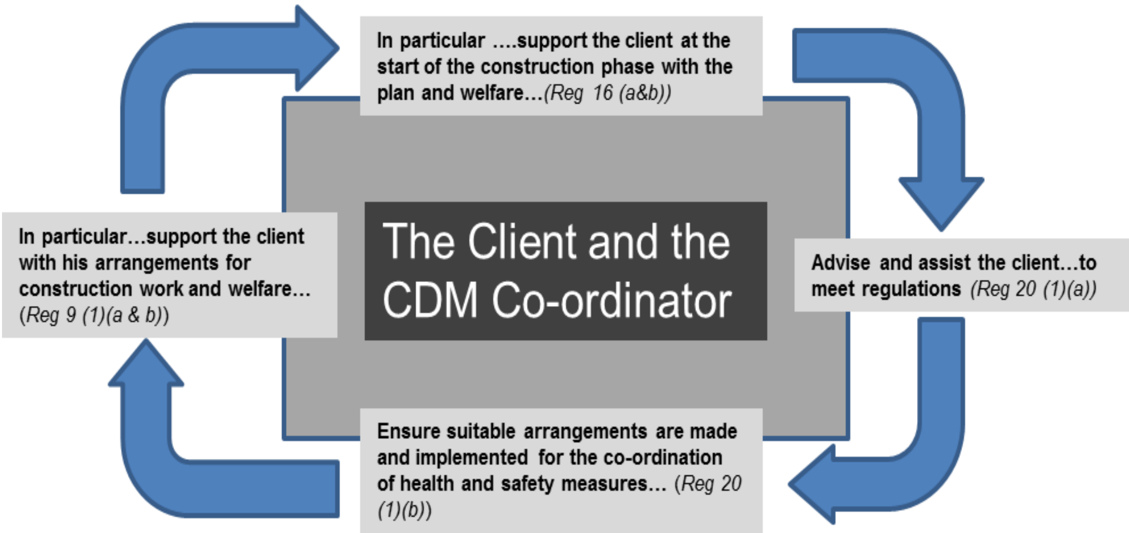

Figure 4.6: The Client and CDM Co-ordinator relationship (Adapted: Summerhayes, 2008)

4.4.1.7 Duties of the Designer under the CDM 2007

The Designer is a key duty holder even though their appointment is not explicitly expressed in the regulations, perhaps because of their already established conventional role in construction. Unsurprisingly though, Designers are required to perform their duties on both a non-notifiable and notifiable project. This role is crucial towards the implementation of the general principles of prevention. In line with Article 4 of the TMCS Directive, it suggests paying attention to the various design stages of a project, particularly "when architectural, technical, and/or organisational aspects are being decided […]." Clearly, this role is vitally important, further demonstrated below. Examples where crucial design decisions led to improved safety were demonstrated by Arnold *et al.* (2011) and Webster (2013); illustrating their potential influence towards CDM implementation and compliance. A full description of the duties undertaken by the Designer is provided in Table 4.11.

Table 4.11: Duties of the Designer

Regulation	Description of duties
11(1)	Not to commence work in the event that a client is unaware of their duties
4(1)(a)	Ensure a competent designer is engaged by taking appropriate checks
4(1)(c)	Ensure the worker instructed to carry out design work is competent or is under competent supervision
11(3)	Take appropriate action to avoid foreseeable risks to the health and safety of any person (i) involved in carrying-out construction work; (ii) likely to be affected by construction work; (iii) maintaining or using the structure designed as a place of work

Regulation	Description of duties
11(4)	Eliminate hazards which are foreseeable and lessen risks from unavoidable hazards
11(5)	Take into consideration provisions of the Workplace (Health, Safety and Welfare) Regulations 1992
18(1)	Commence design work in relation to the project after the appointment of the CDM Coordinator
18(2)	Take reasonable steps towards provision of design sufficient information regarding the structure or its maintenance in order to assist the CDM Coordinator

As such, the stakeholder appointed in the role of Designer in the context of the CDM 2007 is instrumental towards risk elimination prior to the construction phase. This is consistent with the suggestion in the ACoP that acknowledges the unique role of Designers to reduce risks arising during construction and as such can make a significant contribution towards hazard elimination at the design stage (see Paragraph 109 of the ACoP).

To understand the context of what is meant by 'designing out risk', examples of potential hazards and designing out risk are shown in Table 4.12. From the examples, it is clear that the Designer can facilitate intervention measures that deal with construction worker safety. Of course these design decisions need to be extended to not only the construction workers and the general public, but also users of the facility once completed; further considering those involved during its maintenance (Hinze and Wiegand, 1992).

A seminal study commissioned by the HSE that stands out addressing the influence of design decisions of various case studies was conducted by Bennett and Gilbertson (2006). In this study, several design decisions embedded within 18 case studies were analysed and discussed in the context of: (i) the issue, (ii) the design decision, (iii) the commercial case, and (iv) H&S benefits, after which conclusions were drawn. The conclusions drawn rely heavily on the argument that supports the role of the Designer in designing out risk.

Table 4.12: Examples of key safety hazards and designing out risks

Example of potential safety hazard in practice	**Explanation and steps towards designing out risk**
Falling from height	Falling from height is the biggest (single) cause of fatalities. There are steps that can be taken at the design stage to eliminate or mitigate this e.g. prefabrication, maintenance strategies.
Vehicles and other transport	The likelihood of being struck or crushed by construction (or 'in use') vehicles is reduced by strategic consideration of circulation, separation and space. During construction, the contractor is responsible for the detailed implementation, but the designer can sometimes facilitate this by appropriate consideration during the design phase. In use issues will need to be discussed with the client.
Power cables and electrical installations	The risk of electrocution emphasises the need for goal information (from surveys if necessary) and avoidance of unnecessary activity in the vicinity of electrical supplies. This is particularly important on refurbishment/extension projects.
Structural instability	Risk of collapses typically applies to buildings and trenches. Be extra vigilant when refurbishing buildings. Consider carefully the need for deep trenches and their excavation, if adjacent to other works.
Slips, trips and falls	These account for large number of injuries and are very disruptive and costly overall.
Others	Project-specific hazards e.g. significant fire risks arising from the design.

Source: CITB (2007)

4.4.1.8 Duties of the Principal Contractor (PC) under the CDM 2007

The PC is engaged not only to prepare the Construction Phase Plan (CPP) (see Regulation 23(1)(a)), but also facilitates its implementation (Regulation 23(1)(c)). In order to achieve this mandate, the PC reviews, updates and revises the CPP (see Regulation 23(1)(b)). A list of the duties of the PC is provided in Table 4.13. Although it is not exactly known who takes on the role of PC in practice as argued by Mzyece *et al.* (2012a), paragraph 147 of the ACoP suggests that the main or managing contractor is likely to assume this role.

Similarly, a research conducted by Webster (2013) identified the "Tier 1 contractor" as the PC. Others even refer to the PC as the "lead contractor" (Evans, 2008) or a "major UK contractor group" (Williams, *et al.*, 2013). As such, discharging these duties requires adequate resourcing as reiterated in the industry guidance report (see CITB, 2007e).

Table 4.13: Duties of the PC (CDM 2007)

Regulation(s)	Description of duties
23(1)(a)	Prepare the construction phase plan before construction work and pay adequate attention to information provided by the designer
23(1)(c)	Implement the construction phase plan so as to ensure the health and safety of all persons carrying out the construction work
23(1)(b)	Update, review and revise the construction phase plan when appropriate throughout the project
23(2)	Take all reasonable steps to ensure that the construction phase plan identifies the risks to health and safety
22(1)(a)	Ensure that the construction phase is planned, managed and monitored in a reasonably practicable manner, while facilitating cooperation and coordination between contractors and pursuance of the general principles of prevention
22(1)(b)	Liaise with the CDM Coordinator and Designers regarding any design/or change to design during the construction phase
22(1)(c)	Ensure provision of adequate welfare facilities throughout the construction phase
22(1)(d)	Draw up site rules where necessary for health and safety, appropriate to the construction site/activities
22(1)(e)	Offer reasonable directions to any contractor when necessary to enable compliance with his duties under the Regulations
22(1)(f)	Ensure that contractors are informed of the minimum amount of time required for preconstruction planning before actual construction work
22(1)(g)	Consult contractors where necessary before finalising the part of the construction phase plan relevant to his work
22(1)(h)	Ensure all contractors have access to the relevant part of the construction phase plan before actual construction work
22(1)(i)	Ensure contractors are given sufficient time before construction work to prepare and provide welfare facilities and carry out work without risk
22(1)(j)	Ensure each contractor promptly provides construction activity information likely to be required by the CDM Coordinator for inclusion in the health and safety file
22(1)(k)	Ensure project notification particulars are displayed in a legible manner so as to be read by any worker engaged in the construction work
22(1)(l)	Take reasonable steps so as to prevent persons unauthorised to access the construction site
22(2)	Ensure site induction and training is provided to every worker carrying out the construction work
24(a)	Facilitate cooperation with workers engaged in the construction work and developing measures to ensure health, safety or welfare of workers and checking the effectiveness of such measures
24(b)	Consult workers or their representatives on matters regarding the project in line with their health, safety and welfare
24(c)	Ensure that workers or their representatives can inspect and take copies of any planning and management information, which relates to the project.

4.4.1.9 Duties of the Contractor under the CDM 2007

Traditionally, the Contractor had the overall responsibility for H&S because of Section 2 the HSWA 1974. However, in the advent of the CDM Regulations, it is well known that this responsibility is shared. Nonetheless, this has not relived the Contractor of his duties. It is the Contractor’s responsibility to ensure the execution of construction activities with minimal risks. Further, it is the Contractor’s duty to ensure that essential steps are taken before the start of the construction phase such as making sure the Client is aware of their duties, liaising with the PC regarding the CPP and so forth.

Most importantly, the Contractor must ensure that construction work is planned, managed, and monitored; and where necessary provide appropriate training (see Regulations 13(2) and 13(4)). Managing subcontractors is also crucial. It is also important that the resourcing is adequately checked (e.g. staff, time etc.) to ensure that they are capable of executing their duties. If not managed properly, subcontracting may be a weakness rather than a strength (e.g. Manu *et al.*, 2011). The CITB (2007d) explains that it is best practice to stipulate in the contract that they are to adhere to H&S arrangements and likewise they should do the same for their subcontractors. Further, the Contractor must ensure the provision of welfare facilities on the construction site in accordance with Regulations 26 to 44 (see Table 4.14).

Table 4.14: Duties of the Contractor (CDM 2007)

Regulation	**Description of duties**
13(1)	No construction work shall commence unless the client is aware of his duties under the regulations
13(2)	Ensure that construction work is planned, managed and monitored and carried out with no risks to health and safety
13(3)	Ensure that any contractor/subcontractor engaged is aware of the amount of time set for planning and preparation
13(4)	Provide information, training, site induction, site rules and procedures and measures identified towards risk assessment to every worker engaged to carry out construction work
13(5)	Provide any employee with health and safety training
13(6)	Prevent access to persons with no authorisation on the construction
13(7)	Provide welfare facilities throughout the construction phase
26 – 44	Comply with the duties of health and safety on construction sites

4.4.2 Challenges associated with the CDM 2007 in practice

Since their introduction, the CDM 2007 have faced strong criticism, industry debates and a whole host of concerns surrounding their implementation, perhaps more so their interpretation. A year on after their introduction, Klein (2008) suggested three areas in which CDM 2007 could make a difference (i.e.) – (i) procurement; (ii) management of risk; and (iii) corporate competence. However, results based on Government commissioned reports, industry driven reports as well as existing anecdotal and empirical evidence proved otherwise. Most of these studies found that there are widespread concerns regarding the implementation of the CDM 2007. For example, in the early days (2 years on after their introduction), a survey carried out in the summer of 2009 by Dalby revealed widespread misunderstanding. Results from the survey suggested that the effective implementation of the regulations was still quite distant for some organisations. Even though 97% of the respondents were committed to CDM 2007 and considered it as a step in the right direction towards H&S performance improvement, over half (54%) were not confident that their duty holding management colleagues understood their obligations (Dalby, 2009). Furthermore, Dalby's findings revealed that two-thirds of the respondents felt a lack of support from key leadership personnel such as the chief executives, which appears to correlate with the organisations deficiencies in a number of areas such as regulation policy and its implementation (Dalby, 2009).

Others have reported problems associated with the competence of the CDM-C role, in terms of lack of provision of preconstruction information and inadequate preparation of the H&S File (e.g. Rennison *et al.*, 2011). Rennison *et al.* (2011) strongly argued that there was considerable uncertainty surrounding the competence of the CDM-C; provision of pre-construction information; and over duplication of the H&S File contents. These findings were based on a review of a wide range of surveys from industry expertise and professional bodies, and clearly, there was need for greater clarity of roles, improved information flow, and the need for further consideration into the compilation of the H&S File (Rennison *et al.*, 2011, p.43). These concerns demonstrate that there is significant room for improvement regarding the practical operations of the CDM 2007.

Concerning specific duty holder obligations, Tietz (2007) argued that the tasks and liabilities imposed were open-ended while disproportionately expensive when compared against quantifiable H&S benefits. Additionally, although early appointment was viewed as good practice, contributions by the CDM-C remained intermittent and unclear (Tietz, 2007, p.24). Tietz points out specific issues to do with lack of precise experience, risk aversion, and better definition of responsibility as underlying causes of concern when implementing the CDM 2007.

It is of no surprise therefore that on many occasions the role of CDM-C has been criticized for providing intangible benefits; giving rise to bureaucracy and adding additional costs to a project (e.g. Watson, 2010). To the contrary, it can also be argued that the timing of their appointment and competence assessment is crucial (e.g. Chan, 2009). To this end, an evaluation report prepared by Frontline Consultants (2012a) suggests that the main problem was with the interpretation of the Approved Code of Practice (ACoP) rather than the regulations themselves. On the other hand, a membership survey involving 289 firms conducted by the Specialist Engineering Contractors' Group (SEC) regarding their experience of working with the CDM 2007 revealed that duty holders misunderstood their obligations. They were completely unaware of the implications of their responsibility, and because of this, it was envisaged as their biggest challenge. Practical issues such as the CDM mobilisation period were generally overlooked or omitted from the overall construction programme (SEC, 2010), and the problem was magnified during the construction phase. It is these challenges in practice that have spurred suggestions for a review of the CDM 2007 (e.g. Löfstedt, 2011). Perhaps the issue here is standardization of processes to trigger safe work practices as demonstrated by Price and Lu (2013).

Before establishing provisions contained in the new regime (CDM 2015) and the main requirements in support of optimal implementation of the CDM Regulations, Table 4.15 provides a summary describing the main shortcomings that emerge from the literature review. However, much of these concerns provide no indication regarding the discharge of individual duties and the perceived degree of importance and difficulty. It is therefore unequivocal that there is need for more research in this regard to establish the practical discharge of duties and examine its relationship with the perceived degree of importance and difficulty of duties.

Table: 4.15: Literature review summary: implementation of the CDM Regulations

Main shortcomings	Timing of appointments	Competence of duty holders	Bureaucracy	Generation of excessive paperwork	Misinterpretation of the CDM Regulations and accompanying guidance	Ambiguity of responsibilities	Lack of training and supervision	Misunderstanding of duty holder roles	Industry practice and norms	Inadequate prosecutions	Lack of awareness	Missed opportunities to manage risk at design stage	Lack of compliance and leadership support
CDM 1994 regime													
The Consultancy Company (1997)			✓	✓		✓		✓					
Baxendale and Jones (2000)	✓	✓	✓	✓	✓		✓	✓			✓	✓	
DETR (2000)								✓					
Howarth *et al.* (2000)													
Langford *et al.* (2000)													
Griffith and Philips (2001)	✓		✓	✓	✓	✓	✓		✓		✓		
Lamont (2005)									✓				✓
Carpenter (2006b)									✓				✓
Bennett and Gilbertson (2006)		✓				✓			✓		✓		
Bomel Ltd (2007)	✓	✓	✓	✓	✓	✓		✓	✓			✓	✓
Beal (2007)	✓	✓	✓	✓	✓	✓		✓	✓	✓			✓
Scopes (2007)	✓								✓				
Oloke *et al.* (2007)								✓	✓		✓		
Rabin (2007)						✓							✓
Barnard (2007)									✓				✓
CDM 2007 regime													
Carpenter (2007)							✓		✓				
Tietz (2007)	✓				✓	✓		✓	✓				
Donaghy (2009)		✓				✓	✓	✓	✓	✓		✓	
Dalby (2009)	✓	✓	✓		✓	✓		✓	✓				✓
Chan (2009)	✓								✓				
SEC (2010)	✓	✓	✓		✓	✓			✓			✓	
Watson (2010)	✓				✓	✓	✓	✓	✓			✓	
Rennison *et al.* (2011)	✓	✓			✓	✓							✓
Löfstedt (2011)					✓				✓				
ICE (2011)	✓	✓		✓	✓	✓			✓			✓	
Frontline Consultants (2011)	✓	✓	✓	✓	✓	✓			✓		✓		✓
Frontline Consultants (2012a)	✓	✓	✓	✓	✓	✓			✓		✓		
Frontline Consultants (2012b)	✓								✓		✓		
Larsen and Whyte (2013)													✓

4.5 THE CDM REGULATIONS 2015 (CDM 2015)

The proposed changes to the CDM 2007 were developed on the basis that the following would be achieved (HSE, 2014d, 2014e):

- shortening and simplifying the regulations;
- withdrawing the ACoP and replacing it with Guidance;
- removing and replacing the role of the CDM-C;
- altering the conditions used to trigger several duties (e.g. threshold for appointment of coordinators);
- removing explicit competence requirements; and
- removing the exemption of domestic Clients from the Client duties.

This is contained in the consultative document (CD261) prepared by the HSE. Issued in the summer of 2014, the aim of the CD261 was to obtain views from practitioners and members of the public in a thorough, transparent, and objective manner. Alongside the intended deliverables, the proposed changes had six objectives as highlighted by the HSE (2014d), that is, to:

(i) maintain or improve worker protection;

(ii) simplify the regulatory package;

(iii) improve health and safety standards on small construction sites;

(iv) implement the TMCS Directive in a proportionate manner;

(v) discourage bureaucracy; and

(vi) meet better regulation principles.

4.5.1 Main provisions of the CDM 2015 and duty holder responsibilities

The CDM 2015 come into force on 6 April 2015, having been laid before parliament on 29 January 2015 and have a transitional period of six months, up to 6 October 2015 (see Regulations 37 and Schedule 4). They comprise of five parts as listed subsequently.

- Part 1: Introduction (Regulations 1 – 3);
- Part 2: Client duties (Regulations 4 – 7);
- Part 3 – Health and Safety duties and roles (Regulations 8 – 15);
- Part 4 – General requirements for all construction sites (Regulations 16 – 35); and
- Part 5 – General 36 – 39).

Unlike the CDM 2007, a Client is required to appoint a designer with control of the pre-construction phase as Principal Designer (PD) and a contractor as Principal Contractor (PC) (Regulation 5), where a project involves more than one contractor. It is envisaged that these changes will achieve better alignment with the TMCS Directive. Thus, the PD replaces the CDM-C. Additionally, notification of a project under the new regime is realigned to the TMCS Directive. For example, a project with more than 20 workers working simultaneously is considered notifiable (Regulation 6(1)). Further, it is the Client's responsibility to notify a project to the relevant authority (Regulation 6(2)), a duty previously discharged by the CDM-C. Other notable provisions include: application to domestic clients (Regulation 7), duties of Designers (Regulation 9), duties of the PD at the pre-construction phase (Regulation 11), duties in relation to the Construction Phase Plan and H&S File (Regulation 12), duties of the PC (Regulations 13-14), and duties of Contractors (Regulation 15).

4.6 MAIN REQUIREMENTS IN SUPPORT OF CDM IMPLEMENTATION

Based on the foregoing discussion it is quite clear that there is need for remedial action towards improved CDM implementation. The CDM Regulations aim to provide proactive measures and steps that lead to improved H&S protection of workers on construction sites, thus reduce accident rates. It is against this background that all concerned parties are required to contribute to the intended objective of CDM in a professional manner.

Clearly, the regulations provide benefits of engaging various parties towards a common goal because of the shared responsibility ethos. However, there is also need for coordination of these processes towards compliance. None compliance as illustrated before, results in breach of duties leading to fines and prosecutions or even imprisonment.

The four pertinent sub-categories of most importance include:

- appointments;
- duty holder obligations (i.e. extent of discharge of discharge duties);
- interpretation and perception of duties (i.e. importance and difficulty); and
- resourcing.

These areas of concern underpin the formulation of an outline depicting the optimal implementation of the CDM Regulations, integrated into two main categories — i.e. team establishment and resourcing.

4.6.1 Team establishment

The timing of duty holder appointments is crucial during team establishment evident from the extant literature as already highlighted. Where a project is notifiable, the Client is required to appoint a CDM-C and a PC; however, it is unclear from the existing literature when such appointments are fulfilled in practice. Paragraph 64 of the ACoP, suggests that appointment of the CDM-C should preferably be discharged soon after the initial design. As such, early appointment is crucial for the overall planning and coordination of construction arrangements as established in paragraph 66 of the same document. Noticeably, it is imperative for the Client to get the timing of appointments right given that it may have a detrimental effect on the implementation of the regulations, discharge of duties and overall planning and management of H&S arrangements. Timing and sequence of the construction process, is expressed in an explicit manner under the Royal Institution of British Architects (RIBA) plan of work, first published in 1964 (Hughes, 2003).

Indeed, it is widely accepted that the RIBA plan of work provides a generic process for implementation stages of a construction project. Even the CITB acknowledge that the RIBA plan of work is an appropriate reference, common in the construction industry as explained in their guidance document for small and one-off clients (CITB, 2007b). Hughes (2003, p.303) explains that the basis for the RIBA's plan of work was summed up in four key phases:

1. assimilation (i.e.) to gather information about a problem;
2. general study (i.e.) study the problem at hand;
3. development (i.e.) produce and develop a solution or solutions; and
4. communication (i.e.) communicates those solutions to people.

It is against this background that the RIBA plan of work is considered as suitable for planning the timing of appointments under the CDM 2007—i.e. during team establishment. Table 4.15 describes the stages of the RIBA plan of work stages 2013.

Table 4.16: RIBA plan of work stages

Stage	Description	Description
1	Preparation and brief stage	Develop project objectives including quality, project outcomes and sustainability issues
2	Concept design stage	Prepare the concept design, including outline for structural design
3	Technical design stage	Prepare technical design in accordance with design responsibility matrix
4	Developed design stage	Prepare developed design including updated proposals
5	Construction stage	Offsite manufacturing/onsite construction

Source: RIBA (2013)

4.6.2 Resourcing

Baxendale and Jones (2000) suggests that knowledge in H&S legislation pertaining to the construction industry; occupational H&S qualifications; and evidence of attendance on notable training courses are viable indicators of adequate resourcing of key persons (duty holders). This resourcing will ultimately determine the cost of one-man hour based on an amalgamation of various resources. Relating resourcing to the discharge of a specific duty is crucial for the successful implementation of the CDM Regulations.

Evidently, adequate resourcing is critical for the duty holder (e.g. Lamont, 2003). It can be used as a determinant for the selection (leading to appointment) of a duty holder as demonstrated in Figure 4.7. It starts by first identifying if the duty holder has worked with the Client on a similar project, after which a performance review is undertaken or the need for steps to determine their suitability. Whilst past performance can provide an indication of the duty holder's expertise, there is a need to be satisfied that such expertise is proportional and meets the needs of the type of construction, whereby unusual circumstances can be dealt with holistically. Moreover, having identified the suitable duty holder, adequacy of resourcing of that particular duty holder is vitally important. As such, training can enhance specific skills development, to ensure adequate knowledge on their duties as well as the overall implementation of the CDM 2007.

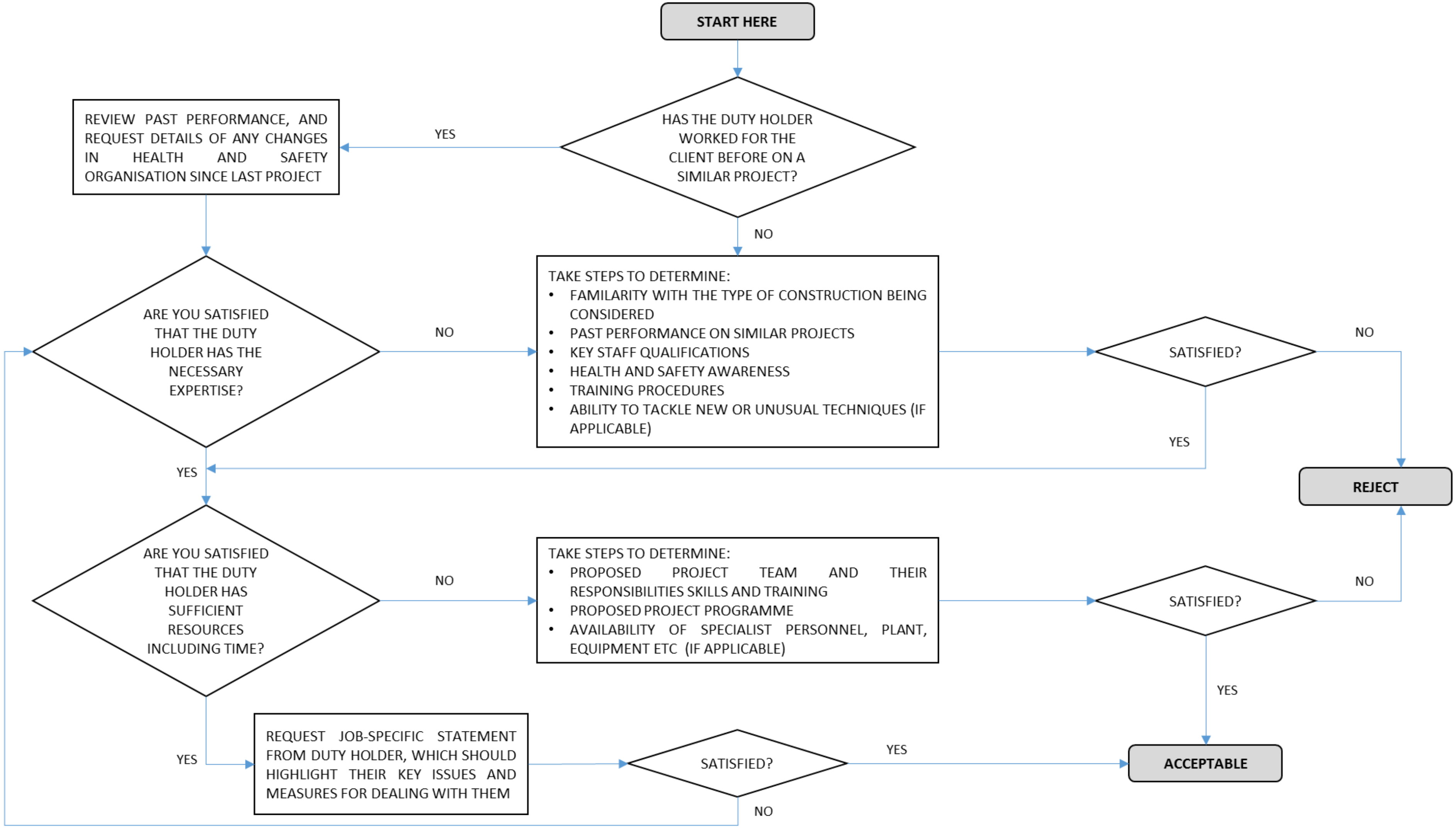

Figure 4.7: Flow chart for performance of CDM duty holders (Source: Mulholland *et al.*, 2005)

4.7 MAIN OUTCOMES OF THE LITERATURE REVIEW

The literature reviewed has shown that H&S performance in the UK construction industry is still a major source of concern. Whilst this observation is largely informed by the available statistics, there are also a number of accomplishments noteworthy. For example, it is clear that since the introduction of primary and secondary H&S legislation, the number of accidents and injuries resulting from construction activities has steadily declined. Arguably, the trend observed from the available statistics shows year on year fluctuations in the number of accidents. To tackle this challenge, strategies such as legislation, modification of behaviour, prevention through design and stakeholder involvement *inter alia* are commonplace, of which legislation offers the most far-reaching impact.

Furthermore, whilst it was established that compliance with H&S legislation is largely based on a self-regulatory style and the shared responsibility ethos, implementation of the CDM Regulations seem to depart from these principles. For example, insufficient input from the CDM-C during the early design stage signals failure to share the H&S burden. Similarly, the misalignment between the CDM Regulations and the TMCS Directive also signals that there is still considerable scope for CDM implementation improvement. Because of these observations, undertaking further research into the practical implementation of the CDM Regulations is necessary. Figure 4.8 summarises the main outcomes from the literature review and describes the way forward based on the identified gap in knowledge.

CHAPTER TWO
MAIN H&S PROBLEMS

- Occurrence of accidents and injuries resulting from construction activities are still a source of concern.
- Poor H&S culture.
- Inadequate use of accident information.
- Lack of engagement of the design community.
- Poor/reactive design.
- Inappropriate enforcement.
- Inadequate training and competence requirements.

CHAPTER THREE
MAIN H&S PRINCIPLES

- Prevention through design.
- Influence of upstream decision-making.
- Self-regulatory style.
- Shared responsibility ethos.
- Collaboration at various levels.
- Safety training.
- Proactive rather than reactive approach.
- Employer to provide equipment and systems.
- Employees to be knowledgeable on the use of equipment and systems.

CHAPTER FOUR
MAIN CDM SHORTCOMINGS

- Mistiming of appointments.
- Competence of duty holders.
- Bureaucracy.
- Generation of excessive paperwork.
- Misinterpretation of CDM Regulations and ACoP.
- Ambiguity of responsibilities.
- Lack of training and supervision.
- Misunderstanding of duty holder roles.
- Industry practice norms.
- Inadequate prosecutions.
- Lack of awareness.
- Missed opportunities to manage risk.
- Lack of compliance and leadership.

KNOWLEDGE GAP

The literature review shows that there is still considerable scope for improved CDM implementation underpinned by the H&S principles and TMCS Directive. However, to establish best practice towards accident mitigation, an examination of the practical discharge of individual duties and the perceived degree of importance and difficulty of duties based on empirical evidence is necessary, to inform any remedial action to be taken for future reform.

Figure 4.8: Main outcomes of the literature review and knowledge gap

4.8 CHAPTER SUMMARY

This chapter began by first introducing the need for management of risk in the construction industry. It then analyses in detail, relevant legislation in relation to H&S in the UK construction industry. Having analysed the main provisions within the primary H&S Directive under the European Communities (Framework Directive), the provisions within the TMCS Directive are also scrutinised. Besides the EU H&S Directives, the UK construction industry introduced the CDM Regulations in response to the TMCS Directive, which largely support the shared responsibility ethos, particularly targeting Clients, Designers, and Contractors. This legislation further introduced two new duty holders—i.e. CDM-C and PC.

Despite numerous shortcomings surrounding the implementation of the CDM Regulations, there is insufficient empirically supported literature on the actual extent of discharge of specific duties across the industry. It is envisaged that such knowledge will bridge the gap between the generic issues regarding implementation problems and their practical implementation in relation to specific duties. The main requirements in support of optimal discharge of the CDM Regulations are established from the literature. They are based on four sub-categories within two main categories—i.e., team establishment and resourcing. From this chapter it is clear that there is still considerable scope to improve CDM implementation given the numerous shortcomings as highlighted by various CDM stakeholders and the misalignment with the TMCS Directive. In order to fulfil the fourth and fifth objective of this study, fieldwork was undertaken to collect primary data. However, before reporting outcomes from the fieldwork, Chapter 5 presents the research design of the study.

CHAPTER 5: THE RESEARCH DESIGN

5.0 INTRODUCTION

The preceding chapter provides an outline of the EU H&S Directives and the CDM Regulations. The main shortcomings associated with the implementation of the CDM regulations are established from extant literature, thus informing the research questions. This chapter therefore discusses the adopted research design and begins by first providing the philosophical context within which the study is formulated. A detailed discussion on the adopted research design strategy and alternative strategies is also provided. Thereafter, a discussion on the procedure embarked on to analyse the primary data and techniques used follows. The penultimate section discusses the validity, reliability, and limitations of the research design.

5.1 CONTEXT AND RESEARCH PARADIGM WITHIN CONSTRUCTION MANAGEMENT

The preceding literature review chapters, outlining the H&S legislation and provisions within key Statutory Instruments, largely inform the choice of approach. Taking these steps ensures attainment of the study's aim and objectives. Thus, the choice of methods; sequence in which the methods are adapted; and philosophical assumptions underpinning the design are of utmost importance into developing this research design (Wisker, 2008; Creswell, 2009).

Construction management research has been acknowledged as a wide discipline and in the main, covers subjects such as natural sciences, social sciences, engineering, and management (e.g. Fellows and Liu, 2008). It has been recognised to conform to such research subjects over a considerable period of time (see e.g. Naoum, 2007; Knight and Ruddock, 2008; Farrell, 2011). Such literature demonstrates the viability of developing a credible research paradigm in the discipline of construction management. Indeed, this link can be established, evident from a thorough and robust research design, coherent to meet the aim and objectives of a study (Naoum, 2007, p.18). It is in the interest of any research that a robust strategy of identifying the philosophical position of acquiring the theory of knowledge (epistemology) is clearly established from the onset. Thereby justifying chosen research methods and the mode of inquiry.

Punch (2005, p. 63) defines a research design as the process in which a researcher guards against, and tries to rule out alternative interpretations of results, logic and rationale. Thus, development of this research design was no different from the approach outlined above; carefully taking heed of the advice provided by Punch. The process involved first, defining the research questions based on the gaps identified in literature, and emerging theories regarding implementation of the CDM Regulations. Second, describing the structure of the research design including steps undertaken; and third establishing the techniques adopted for analysis of primary data; further outlining their significance to the developed remedial action framework as part of the external validation of results. Therefore, the importance of any research design cannot be overemphasised given that it justifies the chosen approach and reinforces fundamental principles regarding knowledge acquisition. As such, the context of this study is framed in the social science subject area.

5.1.1 Role of research questions and philosophical assumptions in the research design

The research questions as already indicated in the preceding section play a crucial role to aid the process of development of the research design, and therefore inform the research design in terms of approach and adapted techniques. Consistent with this view, Tashakkori and Teddlie (1998) reiterate the importance of research questions. They argue that, "the question determines the design of the study, the data collection approach and so on". In order to pursue this view logically alongside other philosophical assumptions that inform the research design, it is crucial to acknowledge the likely influence on the data collection techniques, analysis and overall research framework. It has often been argued that research questions influence the methodological approach of any research. Corbin and Strauss (2008) for example state that, "[…] the research question should dictate the methodological approach that is used to conduct the research", while Black (2002, p.42) also supports the idea that the choice of the research design is dependent on the nature of the research questions and hypothesis.

Indeed, over the past few decades, there have been numerous interpretations regarding issues pertaining to philosophical assumptions (also referred to as the methodological paradigm) in social science research; thereby presenting researchers with several choices (Tuuli, 2009). Acknowledged widely as a contested "terrain" in terms of strategy of design, be it deductive or inductive (Corbin and Strauss, 2008), the importance of the methodological paradigm is important given that it shapes the nature of an investigation; adopted methods; and research questions asked (Denscombe, 2010). Out of the four main epistemology positions established, which inform the methodological paradigm of most social science research—i.e. positivism, interpretivism, critical realism and pragmatism, only three are briefly discussed in Section 5.1.1.1 since critical realism is largely an offshoot of positivism (post-positivism) (Denscombe, 2010). Insights drawn from this discussion underpin the adopted methodological paradigm for this study.

5.1.1.1 The types of philosophical assumptions

The positivism paradigm usually has an inclination towards quantitative research, as such utilises scientific methods in order to gain deeper understanding and knowledge.

Denscombe (2010, p.119) explains that observation and measurement of the elements of an object is a crucial part of social reality. However, positivism demands the affirmation of theories and explanations through scientific research methods (Creswell, 2009). As such, from the summary provided in Table 5.1, it is clear that positivism largely relates to numbers while interpretivism will largely explore words and meaning.

Whereas positivism gains knowledge from measurement of theories, interpretivism relies on human capacities in order to make sense of interpreting the world and therefore leans towards the qualitative research paradigm (Creswell, 2009), which forms an alternative to positivism. It has been observed occasionally that the nature of the interpretivism approach is subjective; gaining knowledge through people rather than objects (e.g. Corbin and Strauss, 2008). Perhaps the greatest challenge for interpretivism as pointed out by Denscombe (2010, p.123) is the ability for other researchers to see things a little different and produce a different account, often leading to some degree of uncertainty (cf. Schwandt, 2001; May, 2011).

Table 5.1 Features of two main paradigms

Positivistic paradigm	**Interpretivism paradigm**
Concerned with hypothesis testing	Concerned with generating theories
Uses large samples	Uses small sample
Data are highly specific and precise	Data are rich and subjective
Produces quantitative data	Produces qualitative data
High reliability	Reliability is low
Low validity	Validity is High
Generalises from sample to population	Generalises from one setting to another

Source: Wisker (2008)

Despite these clear differences, when implemented together as this study advocates for, there is a strong likelihood that the two will complement each other rather than operate in an antagonistic manner. As for the pragmatism approach, the philosophical debates surrounding positivism and interpretivism are of lesser concern (Tashakkori and Teddlie, 1998). The research problem should therefore be the starting point; valued or measured against outcomes in practice, hence suitable for applied research, which tends to focus on the usefulness of research outcomes in practice (Denscombe, 2010). Pragmatism in this regard has often been associated with the mixed methods approach. Its intention is for the applied methods to serve the intended purpose (Denscombe, 2010, p. 128).

Furthermore, Babbie (1990) explains that "in practice, scientific research involves both inductive and deductive reasoning as the scientist shifts from endlessly back and forth between theory and empirical observations." This study therefore advocates for a mixed methods approach based on the ability for the quantitative and qualitative methods to complement each other, while taking into consideration the importance of the research questions in order to resolve the practical problems under investigation.

The research questions therefore developed for this study based on gaps in knowledge are:

1. What are the general trends and practices regarding the discharge of duties of the Designer, CDM Coordinator (CDM-C), and Principal Contractor (PC)?
2. What deficiencies emerge regarding the discharge duties of the Designer, CDM-C, and PC in practice?
3. What are the implications of: practices followed by the Designer, CDM-C, and PC; and changes for future reform?

5.2 AN OVERVIEW OF RESEARCH DESIGN STRATEGIES

In order to develop an informed research design consistent with the practical nature of the research questions, developing a coherent research design with the ability to corroborate theoretical underpinnings is critical. It is in this regard that views surrounding the practical implementation of the CDM Regulations were sought from practitioners during the initial stages of the research. Punch (2005) recommends four questions that can assist the researcher to position the design in the ‘empirical world’. Questions such as “what strategy will be followed”; “from whom will the data be collected”; and “how will the data be collected and analysed”, form the larger part of the design. It is against this background that the initial interaction with industry practitioners provided further insight into the problem. Doing so was considered as a vital step towards developing the research design given the practicality of the research problem (see Chapter 1, Section 1.3). For example, meetings involving continuous professional development, professional practice seminars, professional membership workshops, and keynote lectures presented at various fora by leading experts partly informed the research strategy and led to its subsequent design.

This interaction most importantly provided insight into the practical aspects experienced with CDM implementation. Stake (1995) supports this approach and suggests that particular perceptions of the “actors” are crucial from the onset. Even when there is still scope for further development of theories corroborated by the literature review, leading to the research questions, practically meeting with the ‘actors’ is considered critical. Considering the discussion above, it was therefore determined that a mixed methods approach would be suitable based on a deductive/inductive form of inquiry. In order to fulfil this strategy, a detailed discussion on the qualitative and quantitative methods follows, thereby addressing the research approach and provides a methodical argument in support of the research design.

5.2.1 The qualitative method (inductive approach)

Corbin and Strauss (2008) define the qualitative method as a “process of examining and interpreting data in order to elicit, gain understanding, and develop empirical knowledge”. Unlike the quantitative method, this method is largely shaped by ways in which human activity creates meaning and prefers data to be in the form of words/text rather than numbers (Denscombe, 2010). Sometimes referred to as the 'bottom-up' approach, theories are developed towards the end of the research, although arguably this is not always the case. The qualitative method has the potential to get to the inner experience of participants, to determine how meanings, perceptions, and motives are formed (Denscombe, 2010, p.133).

Data from participants is often gathered by the use of structured or semi-structured interviews in order to generate theories (Farrell, 2011); a procedure commonly known as the inductive approach (Creswell, 2009). While others have alluded to this method as dealing with words rather than numbers, one of its main features is developing theories. Its application in this study is justifiable largely based on the nature of the research problem, particularly the practical aspects of discharging the Designer's duties in order to comply with the CDM 2007. As such, interviews were perceived as a viable data collection strategy (e.g. Haigh, 2008). However, because of the difficulty to develop a sampling frame for Designers given their wide definition in the context of the CDM 2007, interviewees were purposefully selected, utilising snowball as a sampling strategy. Moreover, theoretical saturation was approached, as such predicted that conducting more interviews would yield informational redundancy. Indeed, it is commonplace to rely on a small number of interviews in construction related research. For example, Williams *et al.* (2013) conducted seven interviews from willing participants from an electronic survey and Wamuziri (2013) undertook six interviews with senior safety/project managers in construction organisations. Atkinson and Westall (2010) on the other hand undertook three in-depth interviews with senior project managers, as a follow-up to their statistical study. The foregoing therefore demonstrates the viability of undertaking research that relies on a small number of interviews.

The main weakness of interviews is the inability to utilise any form of objective analysis in the form of numbers and statistical tests (Denscombe, 2010) and because of this insight, adopting a mixed method approach discussed in Section 5.2.3 is advantageous. Further, others have suggested the use of a combination of sources of data, although arguably this will depend on the identified problem and formulated questions (e.g. Corbin and Strauss, 2008). Interviews in this regard were considered appropriate for the qualitative approach given the small sample identified.

5.2.2 The quantitative method (deductive approach)

The quantitative method, also referred to as the top-down approach (or deductive approach) tends to relate to positivism as acknowledged on numerous occasions (e.g. Fellows and Liu, 2008; Bryman, 2008). Through quantitative data, this study was able to detect patterns of activity, which in most instances invite some form of measurement or statistical analysis. Its emphasis is on providing a structured approach (Denzin and Lincoln, 1994). However, even though there appears to be some consensus that the quantitative methods are objective, Denscombe (2010) explains that critics suggest otherwise, given that processes of data collection and analyses are more often than not, subjected to some form of judgement or interpretation, thus a lot of thought was invested when applying this method, by proceeding cautiously.

Once a theory has been put forward, the aim will be to test/verify this theory rather than develop it later (Creswell, 2009) and analysis of quantitative data will either take the form of descriptive or inferential statistics. The former applies where there is one variable (Ferrell, 2011, p.112), while the latter will consist of two or more variables. The quantitative analysis techniques applied in this study are discussed in Section 5.7.

5.2.3 Mixed methods approach, strategies and implications

The use of a mixed method approach in this case means the combination of data collection methods and its subsequent analysis. Creswell (2009) identifies four essential elements of considerable importance when carrying out mixed methods, namely: timing, weighting, mixing, and theory. Timing considers the sequence of data collection, be it sequential or concurrent and its subsequent order. As for weighting, this aspect considers which method has priority over the other. For example, the quantitative method may have more 'authority' over the qualitative method or vice-versa, while other studies may demand equal weighting. For purposes of clarification, the quantitative method has been abbreviated as "QUAN" to signify more weight, while "quan" implies less weight. Similarly, under the qualitative method, "QUAL" refers to more weight and "qual" for less weight.

Based on the established acronyms and categories of weightings above, Tashakkori and Teddlie (1998) classified the mixed methods design in three groups as noted below.

1. The equivalent weight design where a sequential approach is adopted (i.e. QUAN/QUAL and QUAL/QUAN) or a parallel (concurrent) approach i.e., QUAN + QUAL and QUAL +QUAN).
2. The dominant or less dominant design, where one method is more or less dominant, either in the sequential or in the parallel approach (i.e. QUAN/qual and QUAL/quan or QUAN + qual and QUAL + quan).
3. The third category involves designs with a multilevel approach and use.

The actual mixing of the methods employed at various stages may take several forms. This is largely influenced by the research questions and adopted research design. As such, its application in mixed methods will either be deductive i.e.—tested or verified; inductive, where it emerges towards the end of the study; and as a guide for a study (Creswell, 2009). Undoubtedly, the benefits of the mixed methods approach are in the ability to combine data sources based on quantitative methods and those of qualitative ones.

This study adopts the third category that recommends a multilevel approach. Initially interviews with Designers were undertaken after which two surveys were embarked on concurrently. This multilevel approach takes the form of a sequential format followed by a concurrent one. In terms of weighing, the interviews were deemed less dominant, while the surveys more dominant (i.e. qual $\rightarrow$ QUAN + QUAN) carried out sequentially (Creswell, 2009). This was referred to as the less dominant/dominant mixed methods design. In this design, the arrow indicates that the data collection is carried out sequentially, while the plus sign, implies that the design is parallel or concurrent (Creswell, 2009; Bryman, 2012). It is therefore unsurprising as the name suggests, that the mixed methods design will often incorporate elements which are both quantitative and qualitative and tends to reside between the two (Creswell, 2009). It is worth reiterating at this point that the mixed methods approach does not necessarily fit with the ontology or epistemology of positivism (quantitative approach) or interpretivism (qualitative approach). Rather, its application is based on the usefulness of either methods (Denscombe, 2010). As such, it is generally agreed that there combined use will ultimately provide greater insight and understanding of the research problem (e.g. Creswell, 2009).

5.3 ADOPTED RESEARCH DESIGN STRATEGY

Given that the nature of the research questions originate from practical issues faced in the construction industry, the mixed methods approach is suitable for this study based on utilising different forms of data collection and analysis (Creswell, 2009). This kind of research design and approach is therefore largely informed by the pragmatism methodological paradigm as defined by Morgan (1997), Tashakkori and Teddlie (1998) and Denscombe (2010). Table 5.2 outlines the research questions and the sequence of the data collection strategy. Furthermore, Creswell (2009, p.142) suggests other models for writing mixed methods questions, i.e.—writing only quantitative or qualitative questions alone or indeed a combination of both. He further describes three procedures that can be utilised for a mixed methods inquiry as elaborated below:

- transformative
- sequential
- concurrent.

The transformative procedure involves the researcher using a theoretical lens, which acts as an overarching perspective within a design, which contains both quantitative and qualitative data collection and outcomes, while the sequential procedure seeks to expand findings of one method with another (Creswell, 2009). Figures 5.2a and 5.2b illustrate the mixed methods strategy adopted for this study. The strategy first shows the sequential format for the data collection, within which is embedded a concurrent quantitative research design (Creswell, 2009, p.210). The multilevel strategy consists of combining data in qualitative and quantitative form, although arguably in this study the qualitative data is less dominant as already established.

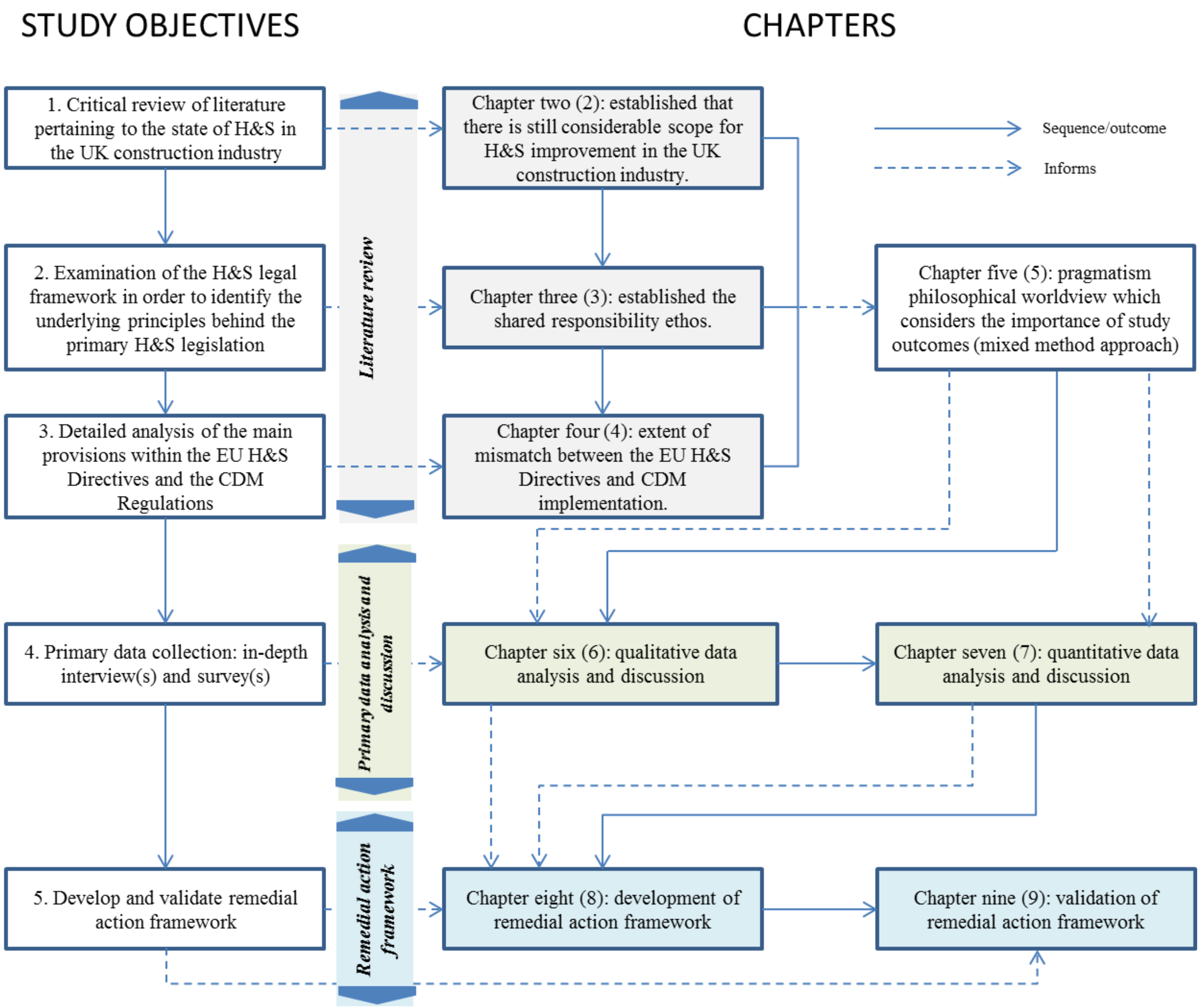

Figure 5.1: Study objectives and sequence of chapters

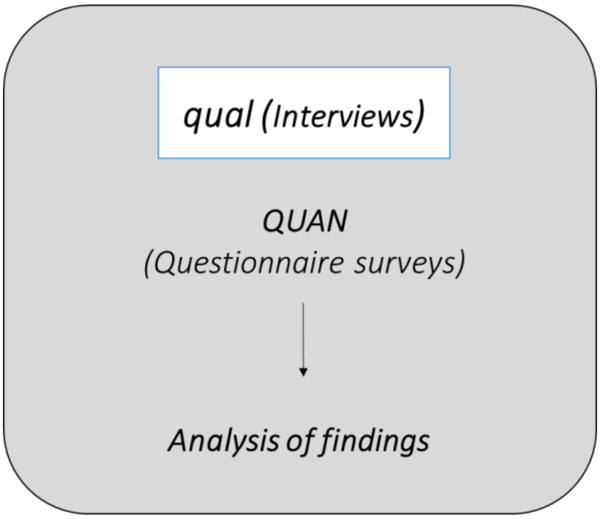

Figure 5.2a: Sequential mixed methods design (Adapted: Creswell, 2009)

The advantages of adopting this framework are two-fold, i.e.—(i) it reduces the weaknesses inherent within one method; and (ii) increases the strength of either method, achieved by mixing the data collection and interpretation of results. However, since the sequential strategy is likely to take a longer duration, the concurrent strategy was deemed more appropriate given the limited duration of this study and its subsequent ability for the corroboration and integration of results (Creswell, 2009). There is also a possibility that findings from either method may reveal potential areas for further research (Tashakkori and Teddlie, 1998).

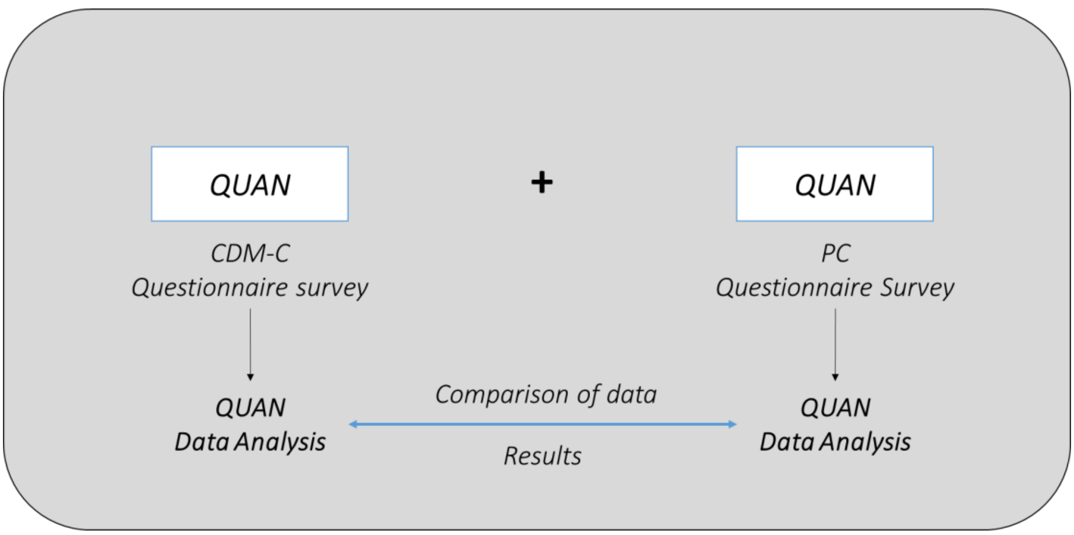

Figure 5.2b: Concurrent mixed methods design (Adapted: Creswell, 2009)

5.4 ALTERNATIVE RESEARCH DESIGN APPROACH

Before discussing the data collection procedure adopted for this study, this section provides insight into alternative approaches. It is often of no surprise that a topical research will receive significant attention, either because it is of interest to the respondents or indeed, because it is a means of channelling the respondent's views. Either way, this is perhaps better achieved by means of an in-depth study design which presents rich data obtained by means of "*case studies, ethnographies, phenomenology, and grounded theory*" approaches (Denscombe, 2010, p.102). Qualitative in nature, these methods can be considered as alternatives for this research design. However, due to time constraints, confidentiality and limited resources to embark on such an approach, it proved futile to go down that route. Further, considering the sensitivity of the subject, it seemed impracticable to locate all the duty holders. Despite these hindrances, the next section provides a brief discussion on the Delphi technique and the case study approach, given their viability.

5.4.1 The Delphi technique

The Delphi technique is an approach similar to focus groups, although performed in a structured manner (Fisher, 2004). Since the nature of implementing the CDM Regulations, involves three or five stakeholders at the same time, reaching a consensus to determine interpretation of the regulations is a viable strategy. It is against such a background that the Delphi technique was considered as an alternative approach. Fisher (2004) explains that it can be used to develop a consensus on an issue that involves judgment, competing priorities, and the likelihood of future scenarios.

Due to concerns surrounding implementation of the CDM Regulations as identified in Chapter 4, adopting the Delphi technique may indeed prove viable for future research.

The Delphi technique involves experts reviewing a series of results from their feedback until a consensus is reached (Field, 2004, p.134). Despite its viability, the Delphi technique was considered costly and time consuming. Pitfalls such as access to a panel of experts representing various stakeholders such as the HSE and reliability/ethical issues were predicted as major impediments in undertaking this approach. An example of its application in H&S performance research can be found in Hardison *et al.* (2014).

5.4.2 The Case Study approach

In the case study approach, the main thrust of the strategy is beyond a cause an effect research paradigm, but rather looks at the 'broader picture' (Denscombe, 2010). This requires conducting an in-depth analysis of a case, be it a person, group, organisation or even a construction project (Naoum, 2007). The case study approach is said to be one that can offer insights into the actual events taking place at a particular point in time (Stake, 1995; Fellows and Liu, 2008; Yin, 2009); driven by the desire to establish a sociological study (Hamel *et al.*, 1993). This method has the ability to obtain data on issues that can provide greater insight into the practical approach of CDM regulations implementation and in particular H&S challenges faced on construction sites (e.g. Cameron and Duff, 2007).

Further, it provides hindsight into understanding how duty holders discharge their duties in practice. The case study design is capable of even exposing trends; often conceived as generalizable to theoretical propositions and not populations (Yin, 2009). It is against this backdrop that the case study approach was perceived as a viable alternative, yet unsuitable due to a number of impediments such as time and accessibility issues.

Table 5.2: Adopted data collection strategy

Research Questions	Data collection sequence	Research strategy	Sampling frame/ method	Data collection instrument(s)	Variable(s) examined	Additional comments
RQ.1 What are the general trends and variances regarding the discharge of duties of the Designer, CDM-C, and PC?	QUAN → qual	Deductive and inductive	• Random, convenience (QUAN) • Purposive and snowball (qual)	• Questionnaire survey(s) (QUAN) • Semi-structured interviews (qual)	Discharge of duties (dependent)	List of PCs based on large to medium size contractors. Designers were purposively selected (i.e. initial contact made during industry CPD workshops.
RQ.2 What deficiencies emerge regarding the discharge of duties of the Designer, CDM-C, and PC?	QUAN → qual	Deductive and inductive	• Random, convenience (QUAN) • Purposive and snowball (qual)	• Questionnaire survey(s) (QUAN) • Semi-structured interviews (qual)	Degree of importance/difficulty (independent)	Further comparison between TMCS Directive and CDM Regulations.
RQ.3 What are the implications of: practices followed by the Designer, CDM-C, and PC; and changes for future reform?	qual → QUAN	Inductive and deductive	• Purposive and snowball (qual) • Random, convenience (QUAN)	• Semi-structured interviews (qual) • Questionnaire survey(s) (QUAN)	Discharge of duties (dependent) and degree of importance/difficulty (independent)	Respondents were asked to provide information on changes required for future reform.

5.5 DATA COLLECTION PROCEDURE AND METHODS

The data collection and fieldwork phase is an important element of any study. In order to fulfil the forth objective of the study, fieldwork to elicit data on current practices with respect to the extent of discharge of duties and challenges experienced was undertaken. Increasingly, by attending industry meetings, training programmes, seminars, workshops and the like relevant to the CDM Regulations, it was established quite early that there was a genuine interest amongst industry stakeholders to improve CDM implementation. Meeting the various stakeholders also proved useful as a snowball sampling strategy to identify the interviewees.

5.5.1 Primary data collection process

The primary data collection involved two methods—i.e. interviews and questionnaire surveys (targeting three duty holders – Designers, CDM-Cs and PCs). The two methods were deemed feasible for the collection of primary data based on the research questions and problem identified which suggests discrepancies in implementation practices involving the CDM Regulations. Prior efforts were made to access contact details of duty holder through the HSE's F10 form, however, this proved futile. As such, it was anticipated that obtaining data from the HSE was going to be a lengthy exercise due to permission granting procedures. Almond (2008) recollects the problems associated with the primary data collection stage. In his experience, the gatekeepers denied him access to HSE regional directors outside the midlands and time constraints were a major hindrance.

5.5.2 The dependent and independent variables

In the context of this study, the extent of discharge of duties is treated as dependent variables, while the perceived degree of importance and difficulty are treated as independent variables. This is slightly similar to the research design adopted by Cameron *et al*. (2013). They treated the roles and responsibilities performed by the safety advisor as independent variables and safety performance as the dependent variable.

Indeed, it is common practice to relate individual competence impacting safety performance (in this case evidence of discharge of duties) as proximal factors (e.g. Gilbertson *et al*., 2011; Cameron *et al*., 2013) and organisational culture as distal factors (*ibid*); both originating from the human error theory by Reason (1990, 1997). The full list of what constitutes dependent and independent variables extracted from the most relevant H&S legislation is explained in Chapters 4 and 7.

The data collection strategy sequence was adapted from Black (2002) (see Figure 5.3). It involved a two-phased strategy (planning and execution) which comprised of seven key steps. The steps undertaken were as follows:

- (i) state research questions and philosophical paradigm to inform approach;
- (ii) determine design structure;
- (iii) identify population and sample;
- (iv) design instruments and classify operational definitions;
- (v) select statistical test for resolving the research questions;
- (vi) carry out plan, collect data; and
- (vii) analyse data, draw conclusions, and evaluate process.

Moreover, because of time constraints, the data collected from interviews and surveys was cross-sectional. Creswell (2009) emphasises the importance of specifying this in the research design. Unlike the longitudinal data collection, cross-sectional data is data collected at one point in time. This is consistent and fits well with the sixth step identified in the adapted data collection strategy (see Table 5.2).

5.5.3 Interviews

Using interviews as a source of primary data is perceived as a viable option, capable of drawing experiences from human beings within a particular setup. Mason (2002) explains that there are four common features of interviewing— i.e. (i) interaction, through which there is an exchange of dialogue; (ii) largely informal in the sense that this could involve face to face contact or a discussion; (iii) thematic approach where the researcher probes themes and issues for discussion; and (iv) understanding meaning through interaction.

Ackroyd and Hughes (1992) on the other hand describe interviews as a method where the researcher asks a series of questions to the respondent. Of importance is the sequence of questions posed to the respondents and the adopted structure. Often, the sequence and structure is recognised to minimise emerging discrepancies (*ibid*., p. 103). Adhering to the advice highlighted, the interviews consisted of semi-structured questions because of their flexibility to offer further probing where necessary. In addition, since most of the interviews were telephone based, apart from one, which was face to face, considering prior arrangements was critical. Issues such as confidentiality, setting up the appointment, and availability of the participants were imperative. O'Leary (2005) provides detailed guidance involving 11 steps, starting with preparation of interview questions and themes. Other aspects such as managing the relationship between the interviewer and interviewee were reiterated; vital, given the sensitivity of the subject and ethical implications. Table 5.3 and Figure 5.4 describe the sequence of the interview questions targeting Designers (see also Appendix 4).

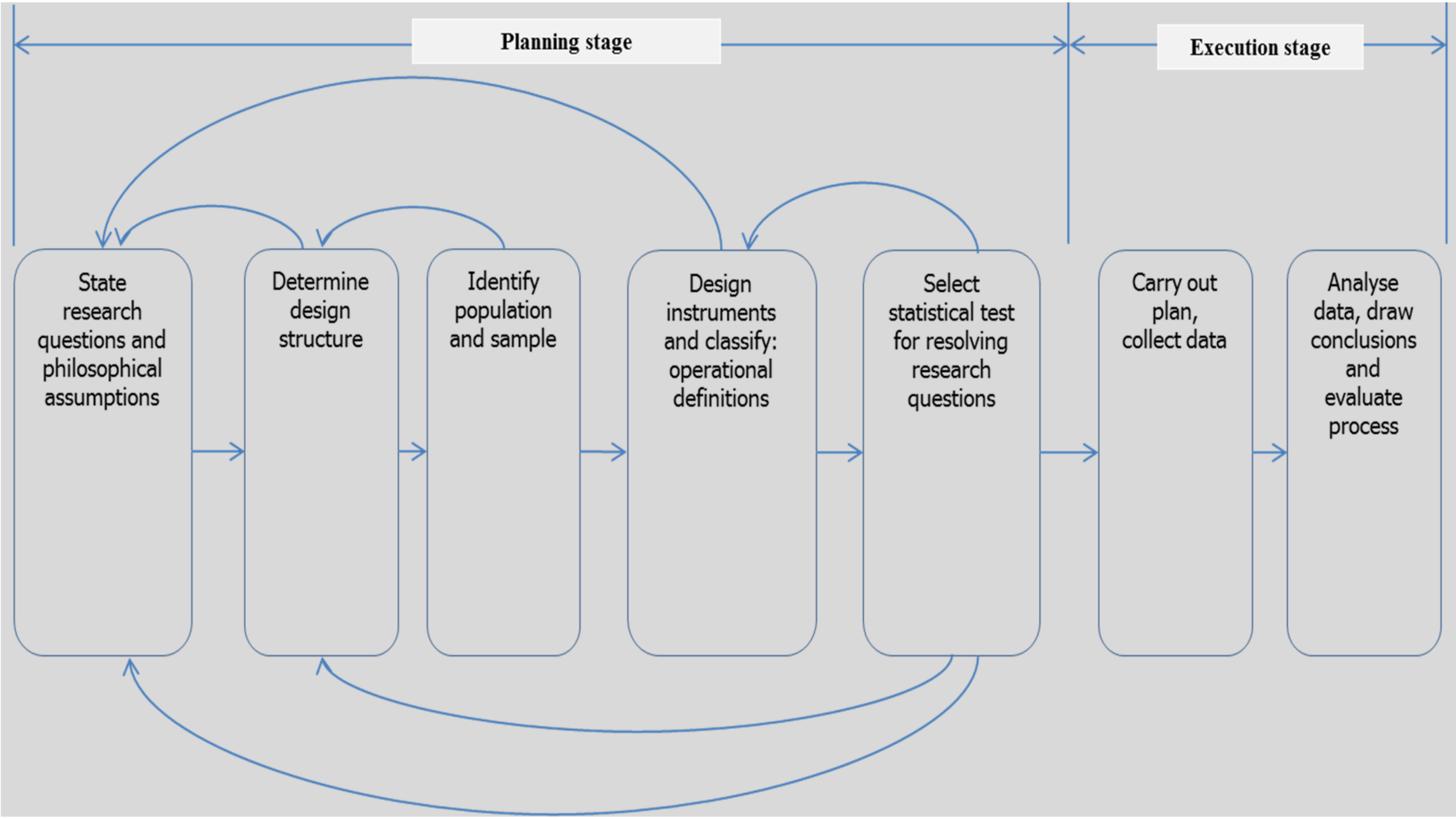

Figure 5.3: Sequence of data collection and analysis (Source: Black, 2002)

Table 5.3 Sequence of interview questions targeting Designers

Section	Description
One	Background information
Two	Concept design stage duties performed
Three	Developed design stage duties performed
Four	Construction phase duties performed
Five	Preparation of H&S file
Six	Changes to the CDM Regulations

Six organisations purposively selected based on their construction design experience and extensive prior knowledge on the CDM Regulations participated in the interviews. Ackroyd and Hughes (1992) argue that the representativeness of interviewees in terms of numbers is less of a concern particularly where a population is unknown (cf. Gibbs, 2007). As such, purposeful sampling is recommended when the sample units are not easily obtainable (Czaja and Blair, 2005). However, it is also advisable to select the interviewees based on defined parameters. Because of this, particular attention was paid to identify the Designers accurately in the context of the CDM Regulations. This was achieved by considering specific parameters such as experience and knowledge on the subject under investigation (Naoum, 2007).

After establishing background information and the interviewee's level of competence, the data sought captures practices regarding the discharge of duties of the Designer (see Figure 5.4). The interviewees were also requested to provide views on the changes required for future reform (see Table 5.3). All these questions are consistent with the research questions presented in Table 5.2. To allow further probing and seek clarification where appropriate, the interview questions were semi-structured.

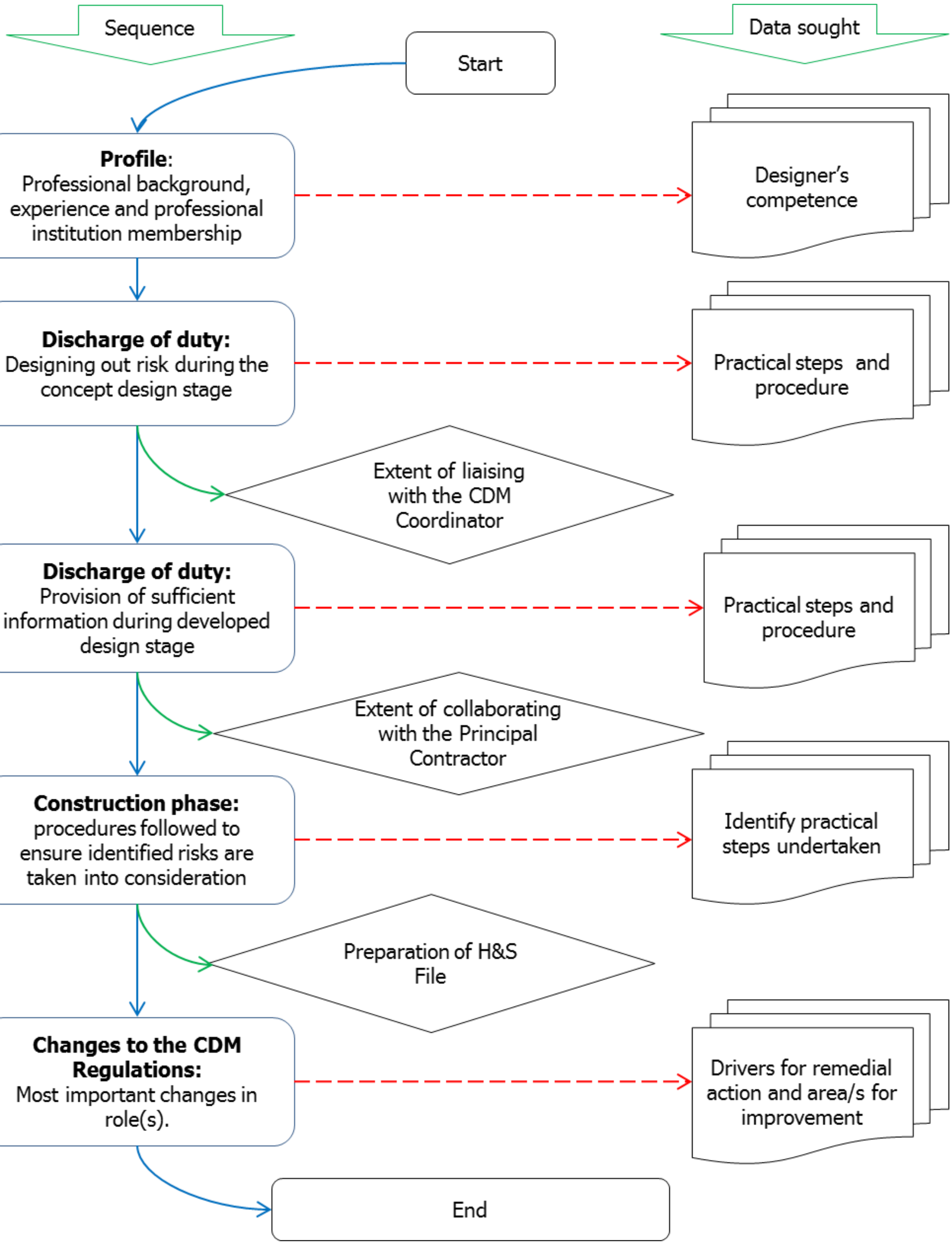

Figure 5.4: Sequence of interview questions – Designers (see Appendix 4)

Despite the wide definition of the Designer as established earlier, for purposes of notification, a lead Designer appointed in the early stages of design may assume greater responsibility than other designers, particularly in the context of the CDM Regulations. For example, paragraph 20 of the ACoP explains that the Architect, lead Designer or contractor responsible for the bulk of design work, normally oversees H&S aspects of the design work. Furthermore, paragraph 116 of the same code of practice defines Designers as those involved in preparing designs, detailed designs, specifications, and bills of quantities among other things. Even Anderson (2010) was of the view that

> *…the definition of 'design' and 'designer' in these CDM regulations* [CDM 2007] *means that any person coming into the industry, perhaps straight out of university, is likely to come under this definition and thus attract the duties laid upon designers.*

Given this observation, application of the non-random method(s) required careful selection of interviewees with potential to answer the research questions and relevant knowledge of the problem (Creswell, 2009). Again, consistent with these views, Tashakkori and Teddlie (1998) offers some advice. They suggest that selecting interview participants involves holding prior information about the individuals or groups. One of the strategies adopted involved selecting the participants based on initial engagements and snowball sampling.

5.5.4 The questionnaire design, procedure, and format/structure

The survey method is preferred and often used on a large population with the aim of generalising the outcome. Self-completed postal questionnaires were deemed suitable for the survey based on the ability to be quicker, cheaper, eliminate "absence of the interviewer effect" and generally offers a rapid turnaround in the data collection (Oppenheim, 1992; Bryman, 2012; Creswell, 2009).

Since the total population of PCs and CDM-Cs largely remains unknown, the sampling frames developed were guided by previous studies such as Scopes (2009a, 2009b) and SEC (2010). For example, the sampling frame developed for PCs comprised of large to medium contractors. Undertaking such steps to carefully determine the sampling frame yields reliable and valid primary data, often perceived as a crucial strategy (e.g. Bryman, 2008), as discussed in Section 5.4. Thus, the postal survey method was utilised based on its ability to provide a wider coverage to collect data from respondents appointed in the roles of PCs and CDM-Cs. Obvious advantages for use of a postal questionnaire as identified by Naoum (2007) include:

- wide geographic coverage at minimum costs;
- speedy return of questionnaires within a reasonable time period;
- offer respondents more time and the opportunity to consultant other colleagues.

5.5.4.1 Questionnaire format/structure

The questionnaire structure adopted was similar for both surveys (See appendices 2 and 3). It largely comprised closed-ended questions based on a five-point likert scale. Further, given the nature of the research questions (e.g. to determine the general trends and variances in practice towards the discharge of duties), utilising the likert scales proved useful. For example, rating the extent of discharge of duties required applying the following likert scale: 5-*Always*, 4-*Often*, 3-*Sometimes*, 2-*Rarely*, and 1-*Never*. Clearly, adopting closed-ended questions proved suitable given that respondents had to rate all the ten duties of the CDM-C and twenty duties of the PC. Additionally, to complement the closed ended questions, semi-closed and open-ended questions seeking to gather information on the professional profiles of the respondents were utilised. This is consistent with the advice offered by Oppenheim (1992). He suggests that open-ended questions are useful when gathering background or general information. By heeding to such advice, primary data was also gathered on changes required to perform various roles under the CDM Regulations. Further, it is also critical that the sequence of the questions flow in a systematic manner. This enhances the chances of responses and as such considered vitally important (see Table 5.4 and Figure 5.5).

Table 5.4: Questionnaire - sequence of questions targeting CDM-Cs

Section	Description
One	Professional background information
Two	Appointment stage as CDM Coordinator
Three	Extent of discharge of duties
Four	Perceived degree of importance
Five	Perceived degree of difficulty to discharge duties
Six	Changes required to the CDM Regulations

Table 5.4 and Figure 5.5 show the sequence of sections in the questionnaire targeting the CDM-Cs. Similarly, Table 5.5 and Figure 5.6 describe the sequence utilised in the questionnaire targeting PCs. They provide a breakdown of the description of sections included in the questionnaire and the data sought.

Table 5.5: Questionnaire - sequence of questions targeting PCs

Section	Description
One	Professional background information
Two	Appointment stage as Principal Contractor
Three	Extent of discharge of duties
Four	Perceived degree of importance
Five	Perceived degree of difficulty to discharge duties
Six	Changes required to the CDM Regulations

5.5.5 The pilot phase

Before embarking on the fieldwork, it was imperative to undertake a preliminary testing of the developed research instruments. This stage, popularly referred to as the pilot phase, in its broadest sense requires testing the viability, validity, and suitability of the developed instruments. For example, Black (2002) suggests going about this process by having them checked by experts, to identify their potential to measure the intended outcome.

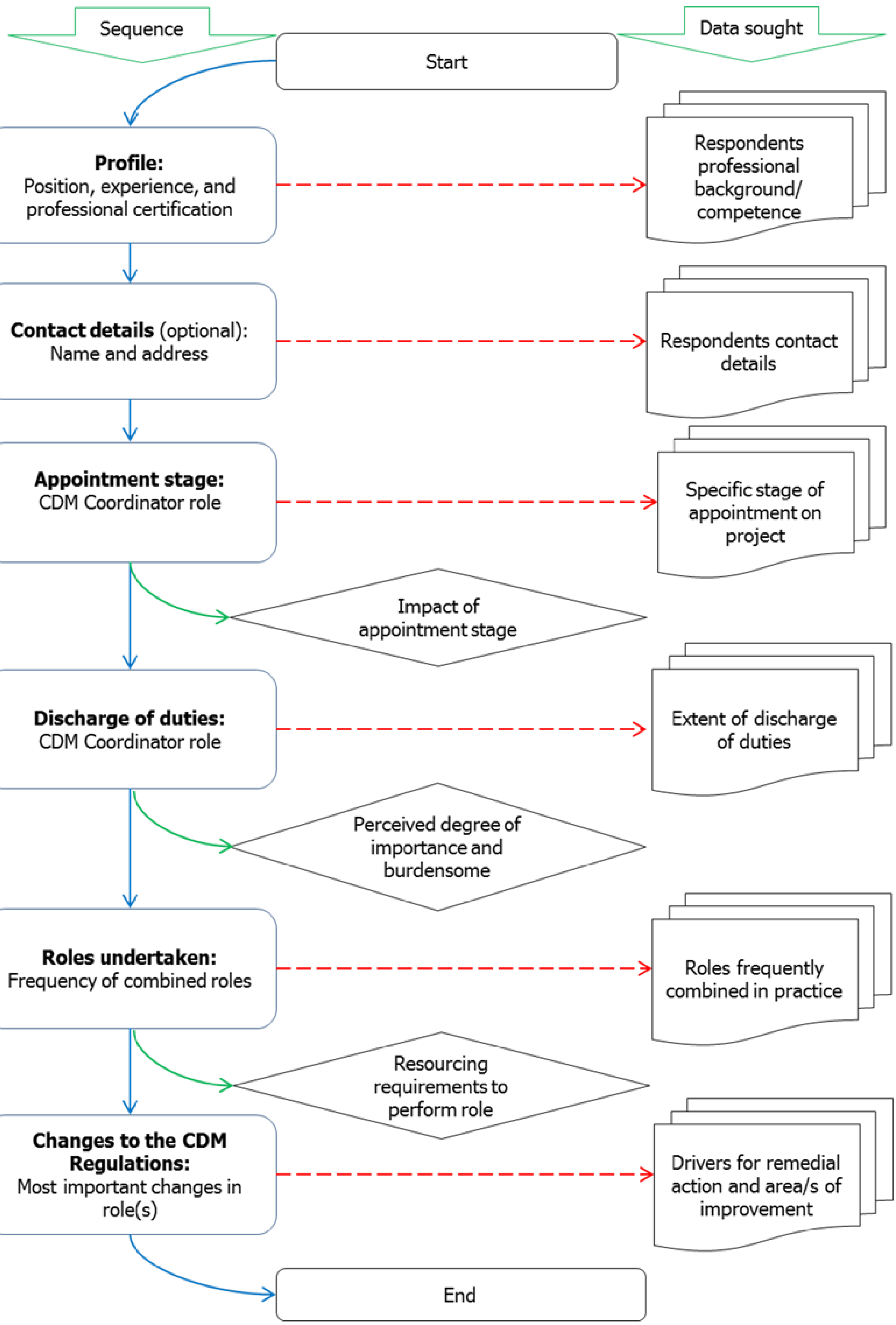

Figure 5.5: Questionnaire section sequence: survey targeting CDM-Cs (see Appendix 2)

Such steps ensure checking the research instrument in terms of consistency, unambiguity, clarity, and sequence of questions among others (Black, 2002, p.240). Moreover, undertaking follow-up interviews proved useful, regarding the interpretation of wording, clarity of questions or even the length of the entire instrument. As such, incorporating highlighted inconsistencies and issues pointed out were fundamental as demonstrated by the instruments' sequence of questions. After the pilot phase involving five of each duty holder, the instruments were updated accordingly.

5.5.6 Sampling

Since it may undoubtedly prove costly and time consuming to target the whole population (Evans, 1995), establishing a sample from the population is of paramount importance during the primary data collection phase particularly when conducting quantitative research (Bryman, 2012). Czaja and Blair (2005) further explain that the importance of defining the target population is beneficial for setting boundaries.

Notably though, the limited amount of resources alluded to previously, made it impossible to target the entire population of contracting organisations in the region of approximately 234,000 (BIS, 2013a). Therefore, developing a sampling frame based on the defined population parameters was imperative. The sampling frame was developed based on size (i.e. large to medium contractors) and drawn from a publicly available online directory (UK Kompass). In order to minimise errors in drawing the sample, increase accuracy, and limit biasness, verification of company addresses by searching readily available registers on the internet such as the 'top UK contractors list' and the 'UK Contractors Group' was essential. These procedures were strictly adhered to so as to give each unit in the sampling frame an equal opportunity to be sampled (Czaja and Blair, 2005).

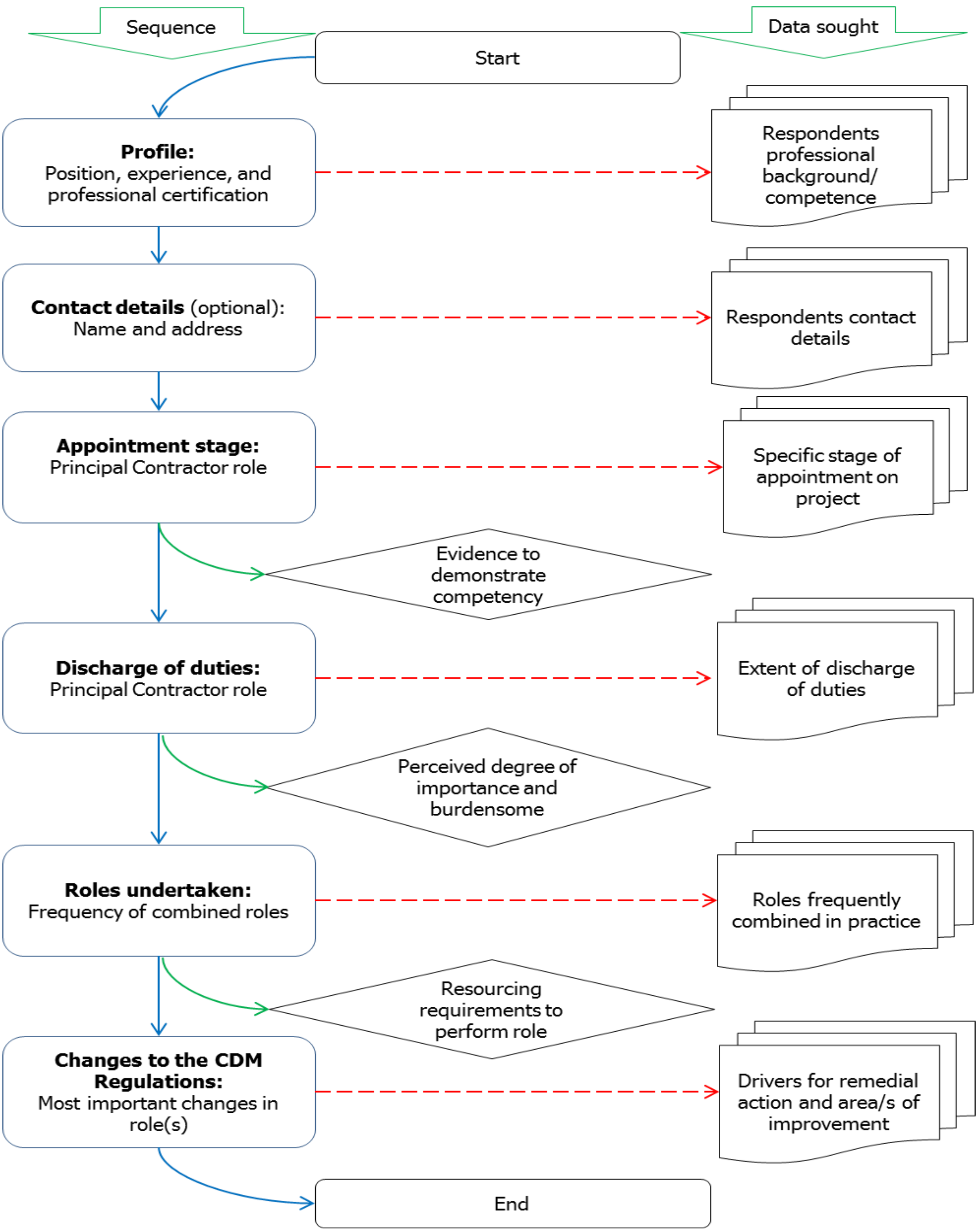

Figure 5.6: Questionnaire section sequence: survey targeting PCs (see Appendix 3)

Previous studies have shown that drawing a sampling frame from the UK Kompass directory is reliable (e.g. Ankrah, 2007; Cheng, 2008). Such studies demonstrate the dependability of information held, although notably the context of study determines the category of contractors required, a strategy described by Czaja and Blair (2005) as screening. The parameters utilised to establish the sampling frame comprising of large to medium contractors required detailed scrutiny of the:

- number of employees (i.e. over 250);
- annual turnover (i.e. > £500,000) (see The Consultancy Company, 1997); and
- size/value of projects.

For example, studies conducted by Akintoye *et al.* (2000) and Akintoye and Main (2007) determined the target population of large to medium UK contractors from a publicly available directory, which indeed corroborates the viability of the adopted strategy.

In order to properly derive the sample size and eliminate any biasness, carefully implemented steps were taken. Following the suggestion by Czaja and Blair (2005), the following formula was utilised to calculate the sample size:

$$ss = \frac{z^2 \times p(1-p)}{c^2} \qquad (\textit{Equation 5.1})$$

Where:

ss = sample size

z = standard deviation

p =percentage picking a choice

c = confidence interval

Assuming a standard deviation of 95% (where the significance level =0.05, *z* =1.96) and the percentage picking choice (p) = 50% while c =± 12), the sample size was calculated as follows:

$$ss = \frac{1.96^2 \times 0.5(1-0.5)}{0.12^2}$$

$$= 66.69$$

Moreover, it is widely reported that the construction industry generally has a sluggish response rate (e.g. Sutrisna, 2004; Ankrah, 2007) and because of this, it was assumed that a moderate response rate of 10% would be attainable. In his study, Sutrisna (2004) distributed 1420 questionnaires and received 125 responses, representing a response rate of approximately 9%, demonstrating the lethargic response rate from the UK construction industry. Oppenheim (1992) suggests taking into consideration the (i) accuracy of the required estimates and statistical significance; (ii) comparisons between subgroups; (iii) dependent variables complexity; and (iv) resources and time constraints when determining the sample size.

As such to correct the sample size, recalculation required taking the following steps as detailed below:

$$new\ ss = \frac{ss}{rr}$$

Where,

ss = the calculated sample size

rr = response rate (percentage)

$$new\ ss = \frac{66.69}{0.10}$$

= 666.9.

With the use of Microsoft Excel to generate numbers, while also bearing in mind the recalculated sample size, 774 randomly selected participants were targeted, likely to be appointed in the role of PC.

As for the CDM-Cs, establishing the population from which to draw the sample required considerable effort and time. Moreover, since there are no proper guidelines relating to the professional discipline of the CDM-C, establishing the population proved futile. However, given that the CDM-C notifies the project to the HSE (see Regulation 21(1)), obtaining CDM-C contact details through the F10 notification form was a viable option. However, because of access restrictions, the alternative was to obtain readily available contact information from a professional membership body.

The Association for Project Safety (APS) was identified as the leading professional body for CDM-Cs, which aims to "be the authoritative membership body in the field of construction health and safety risk management" (APS, 2012). Its mission is to continuously improve and promote the professional practice of construction health and safety risk management; as such, it was clear that obtaining CDM-C contact details was credible. Bryman (2012) identifies such an approach as convenience sampling, available to the researcher by virtue of its accessibility. As such, 226 contact details for registered firms with the APS in the category of CDM-C were obtained with the full knowledge and permission from the APS. Following the developed sampling frame, carrying out a postal questionnaire survey concurrently with the survey targeting PCs was a viable option.

Notable difficulties such as a low response rate are commonplace in postal questionnaire surveys. Bryman (2012) therefore recommends acknowledging the implications and provides a solution of how to go about it. By heeding to such advice, the following steps were undertaken (p.236):

- writing a good covering letter, explaining the importance of the research and why the recipient was selected (see Appendix 1);
- enclosing a self-addressed envelope, preferably stamped;
- follow up individuals who do not reply twice or thrice, preferably starting with a reminder letter two weeks after initial mailing;

- reduction in the length of the questionnaire;
- clear instructions at the top most page with an attractive layout;
- interesting questions to attract attention;
- signing each letter individually; and
- less use of open questions that require the responses to write.

Following the steps above resulted in 74 responses from large to medium contractors appointed in the role of PC (seven of which were incomplete) and 48 responses from respondents appointed in the role of CDM Coordinator (see Table 5.6).

Table 5.6: Questionnaire survey response rate

Category	PCs	CDM-Cs	Overall
Administered questionnaires	774	226	1000
Responses received	74	48	122
Response rate	9.6%	21.2%	12.2%

5.6 RATIONALE FOR CHOICE OF ANALYSES AND PROCEDURES

Before discussing the findings of various statistical tests carried out, it is imperative to provide an explanation on the data analysis process. Since the theoretical and conceptual background underpinning this study was established earlier in the preceding chapters, it is reasonable to go straight into explaining the adopted data analysis procedure.

5.6.1 Preparing the primary data

Having carried out the fieldwork (primary data collection), exploring the primary data before embarking on any data analysis is advantageous. After setting up the structure of the data, data entry and coding, form part of the data preparation process (Pallant, 2011). IBM SPSS version 20 was used to analyse the data. Statistical software packages such as SPSS and MINITAB in the social science discipline have proven popular; reliable in terms of generated findings (e.g. Spiegel and Stephens, 1999; Field, 2013).

Given this already established precedence, it was envisaged that SPSS was capable of producing valid results. Preparation of the raw data was the first step undertaken; identified as an essential step, by developing a 'codebook' in SPSS, yielding several benefits. Various studies conducted in the discipline of construction management demonstrate the benefits gained and insight drawn from the raw data; providing first impressions from the emerging patterns (e.g. Oloke, *et al.*, 2007). The 'codebook' generated in SPSS serves as a summary of the raw data. It is a means for checking less obvious errors, omissions, and outliers. Field (2013) provides an extensive discussion on outliers; defined as an observation or observations very different from the others. Other features of the data such as extremes in responses, the general overview and pattern of responses, and missing data provide an opportunity for early decision making regarding data transformation and so on (Pallant, 2011).

After preparing the 'codebook', the next step undertaken was setting up the structure of the data file. This involved coding of variables, labelling and identifying the variables as dependent (outcome) or independent (predictor). Furthermore, since the measurement of variables is broadly considered to exist within, the categorical or continuous level (Field, 2013); particular attention was paid to this issue. For example, Ankrah, (2007) identified a mixture of these levels of measurement, consisting of nominal, ordinal and scale data. Similarly, this study largely applies two levels of measurement—i.e. ordinal (where the data is ordered) and interval (where equal intervals on a scale represent equal differences) (Field, 2013).

5.6.2 Screening the data for errors

Screening the data for errors is a primary step in data analysis. It is vitally important that checking the data for errors is undertaken in order for one to carry out an honest analysis

(Tabachnick and Fidell, 2007). Errors may occur because of wrongly entered data, omissions in the data, and assumptions applied to the data when applicable.

5.6.3 Exploring the data using descriptive statistics

Following the preliminary steps in the data analysis procedure, use of descriptive statistics was utilised, serving as an important step towards the data analysis. It provides an opportunity for visual inspection of the primary data in its raw form. According to Sirkin (2006), descriptive statistics such as frequencies indicate the number of cases in a particular category, represent rankings and provides a strong basis for further statistical analysis.

The graphical presentation of the data resulting in generating class intervals and frequencies commonly expressed as percentages is useful (Spiegel and Stephens, 1999). However, it is worth mentioning that at this stage, the descriptive statistics merely describe the nature of the data without drawing any conclusions or inference (Spiegel and Stephens, 1999). Among other benefits, the use of descriptive statistics is convenient because of its ability to: (i) summarize the raw data into classes; and (ii) group the raw data into a manageable form and as such providing a clearer overall picture of the data (Spiegel and Stephens, 1999). To aid the explanation of the raw data using descriptive statistics, presentation of the data was largely in the form of frequency tables.

5.7 QUANTITATIVE ANALYSIS

Checking the distribution and normality of the data preceded the data analysis. Scrutinising frequencies, percentages, arithmetic means, medians, and standard deviations was important. Measures relating to central tendency were limited to the arithmetic mean, median and the standard deviation because of their ability to identify extreme values in a distribution (Miller, 1983). Furthermore, the examination of the distribution of the data determines the applicable tests; as such, perceived vitally important because of the decision to support the type of tests to be undertaken. For example, classifying the data as normally distributed and equal standard deviations satisfies the possibility to subject the data to parametric tests. Inversely considered, non-satisfaction of these assumptions, invites the application of non-parametric tests (Spiegel and Stephens, 1999).

The distribution of the data shows an inconsistent pattern of normal distribution which is largely because of outliers (Field, 2013), which inform the choice for application of parametric or nonparametric tests. Understandably, because of the violation of such assumptions to support the decision to carry out parametric tests, it was prudent to apply non-parametric tests.

The normality test applied confirmed that the data was of a non-normal distribution. This was achieved by undertaking the Kolmogorov-Smirnov test and the Shapiro-Wilk test in SPSS. Field (2009) explains that both the Kolmogorov-Smirnov and Shapiro-Wilk test compare the scores in the sample based on a normally distributed set of scores in terms of their mean and standard deviation. Determining the normality distribution is achieved by checking the significance of the result. A non-significant result (i.e. $p > .05$) suggests that the distribution is normal, while a significant test (i.e. $p < .05$) suggests otherwise. The implication of a significant result suggests that the distribution is significantly different from a normal distribution as illustrated in Table 5.7.

Table 5.7: Test of normality (Duties of the CDM-C)

Variables (discharge, burdensome and importance)	Kolmogorov-Smirnov			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	Df	Sig.
Give suitable advise to and assistance to client (Regulation 20(1)(a))	.256	48	.000	.824	48	.000
Ensure arrangements for coordination (Regulation 20(1)(b))	.227	48	.000	.879	48	.000
Take reasonable steps towards identifying and collecting preconstruction information (Regulation 20(2)(a))	.245	48	.000	.821	48	.000
Promptly provide preconstruction information (Regulation 20(2)(b))	.254	48	.000	.824	48	.000
Ensure notice is given to the HSE (Regulation 21(1))	.504	47	.000	.441	47	.000
Liaise with Principal Contractor (Regulation 20(1)(c))	.326	48	.000	.740	48	.000
Take reasonable steps to ensure Designers comply (Regulation 20(2)(c))	.214	48	.000	.875	48	.000
Take all reasonable steps during the construction phase to ensure cooperation between Designers and PC (Regulation 20(2)(d))	.256	48	.000	.864	48	.000
Prepare the H&S File (Regulation 20(2)(e))	.296	48	.000	.739	48	.000
Handover H&S File (Regulation 20(2)(f))	.286	48	.000	.713	48	.000
Give suitable advise to and assistance to client (Regulation 20(1)(a))	.232	47	.000	.835	47	.000
Ensure arrangements for coordination (Regulation 20(1)(b))	.241	47	.000	.888	47	.000
Take reasonable steps towards identifying and collecting preconstruction Information (Regulation 20(2)(a))	.210	47	.000	.905	47	.001
Promptly provide preconstruction information (Regulation 20(2)(b))	.201	47	.000	.882	47	.000
Ensure notice is given to the HSE (Regulation 21(1))	.408	47	.000	.650	47	.000
Liaise with Principal Contractor (Regulation 20(1)(c))	.190	47	.000	.914	47	.002
Take reasonable steps to ensure Designers comply (Regulation 20(2)(c))	.197	47	.000	.882	47	.000
Take all reasonable steps during the construction phase to ensure cooperation between Designers and PC (Regulation 20(2)(d))	.216	47	.000	.904	47	.001
Prepare the H&S File(Regulation 20(2)(e))	.196	46	.000	.894	46	.001
Handover H&S File (Regulation 20(2)(f))	.182	46	.001	.878	46	.000
Give suitable advise to and assistance to client (Regulation 20(1)(a))	.282	48	.000	.802	48	.000
Ensure arrangements for coordination (Regulation 20(1)(b))	.300	48	.000	.751	48	.000
Take reasonable steps towards identifying and collecting preconstruction info (Regulation 20(2)(a))	.276	48	.000	.743	48	.000
Promptly provide preconstruction information (20(2)(b))	.295	48	.000	.746	48	.000
Ensure notice is given to the HSE (21(1))	.256	48	.000	.780	48	.000
Liaise with Principal Contractor (Regulation 20(1)(c))	.269	47	.000	.786	47	.000
Take reasonable steps to ensure Designers comply (Regulation 20(2)(c))	.230	48	.000	.843	48	.000
Take all reasonable steps during the construction phase to ensure cooperation between Designers and PC (Regulation 20(2)(d))	.237	48	.000	.861	48	.000
Prepare the H&S File (Regulation 20(2)(e))	.270	48	.000	.848	48	.000
Handover H&S File (Regulation 20(2)(f))	.263	48	.000	.829	48	.000

(See also Appendix 6 - test of normality, PC duties)

5.7.1 Application of nonparametric tests

The significant differences in the normality test imply that, it was feasible to apply nonparametric tests. Nonparametric tests as the name suggests substitute the normality distribution requirement as well as other parameters required to apply parametric tests (Field, 2013). They are a culmination of ranking the data according to scores (i.e. high scores represent large ranks and low scores represent small ranks), thus eliminating the problem of outliers (Field, 2013). So for example, an appropriate nonparametric test in place of the *t*-test is the Wilcoxon signed rank test. Other tests such as correlation, apply the Spearman's rank correlation coefficient or Kendall's tau test rather than Pearson's product moment correlation coefficient. Further, Friedman's test is preferred in place of the Analysis of Variance (ANOVA) parametric method. As such, applying nonparametric tests ensures consideration of parameters such as skewedness and kurtosis of the data.

The nature of the distribution of the data and the fieldwork comprising of two independent groups discharging different duties, required the application of following nonparametric tests:

- Freidman's test
- Wilcoxon signed-rank test
- Kendall's tau test.

A discussion explaining the use and application of these tests is provided below.

Friedman's test

The Friedman's test is also based on ranked data. Once the data is ranked, the test statistic (F) is derived as follows (Field, 2013):

$$F_r = \left[\frac{12}{Nk\,(k+1)} \sum_{i=1}^{k} R_i^2\right] - 3N(k+1) \qquad (Equation\ 5.2)$$

Where,

R_i = sum of the ranks of the items in sample j

N = total sample size, and

k = number of samples.

Wilcoxon signed-rank test

Use of this test is based on a comparison of two related conditions, particularly instances when scores come from the same respondents (Field, 2009). The test is similar to the t-test (parametric equivalent) and derives differences between scores of two conditions (*ibid*).

In order to calculate the test statistic (T), two scores require analysis of their mean ($\bar{T}$) and standard error ($SE_{\bar{T}}$), given as:

$$\bar{T} = \frac{n\,(n+1)}{4} \qquad (\textit{Equation 5.3})$$

$$SE_{\bar{T}} = \sqrt{\frac{n(n+1)(2n+1)}{24}} \qquad (\textit{Equation 5.4})$$

Where,

n = number of participants/respondents.

By converting the mean and the standard error into a z-score, the significance of the values can be determined (Field, 2009). Converting the mean and the standard error is undertaken as follows:

$$z = \frac{X-\bar{X}}{s} = \frac{T-\bar{T}}{SE_{\bar{T}}} \qquad (\textit{Equation 5.5})$$

A result larger than 1.96 without considering the minus sign, suggests that the test is significant (i.e. $p < 0.05$), implying that the difference is statistically significant (Field, 2009, p.554). It is also worth acknowledging the Bonferroni adjustment when considering *post-hoc* tests. Where a comparison is based on multiple categories to determine the significance of a p-value (Pallant, 2011), a result is considered significant if it is less than the derived p-value: $\frac{\alpha}{n}$, where $\propto$ = desired alpha level and n = number of categories.

For example, when comparing two categories, a p – value less than 0.025 derived from $\frac{0.05}{2}$ is considered significant.

Kendall's tau test

Similar to the Spearman's correlation coefficient, the Kendall's tau test is a non-parametric correlation test. It is preferred over Spearman's correlation coefficient when the sample is small and the rankings are close or tie (Field, 2009). Because of the relatively small data set and similar trend in scores, the Kendall's tau test was utilised to correlate the dependent and independent variables. Numerous authors suggest the use of Kendall's tau test over Spearman's correlation coefficient. This preference is because of its accuracy and as such considered a better estimate (e.g. Howell, 1997; Field, 2009). However, interpretation of the results is similar to the other correlation tests. For example, a relationship where the p-value is less than .01, it can be concluded that it is highly significant (Field, 2009, p.182). Whereas, the strength of the association is measured by the correlation coefficient (r), derived by:

$$\frac{\sum_{i=1}^{n}(x_i - \bar{x})(y_i - \bar{y})}{(N-1)s_x s_y} \qquad (Equation\ 5.6)$$

Where, according to Field (2013) $\bar{x}$ and $\bar{y}$ is the mean of the samples, x_i and y_i is the data point in question. The s_x and s_y is the standard deviation of the first and second variable, and N is the total number of observations.

Relative Index Analysis

The relative index analysis is mostly applicable when ranking results. Sometimes referred to as the 'importance index', 'awareness index', 'success index', 'frequency index' or 'HSM index' (e.g. Ndekugri *et al.*, 2008; Akadiri and Olomolaiye, 2012; Chileshe and

Dzisi, 2012), the rank index is based on ranking relative indices (RI). As such, the RI is computed as follows (see e.g. Jannadi, 1996; Chinyio *et al.*, 1998; Ndekugri *et al.*, 2008):

$$RI = [\sum_{i=1}^{i=5} w_{i\,f_i}] \times \frac{100\%}{n} \qquad (\textit{Equation 5.7})$$

Where w_i= weight for each rating as assigned by each respondent on a likert scale of five to one, which in this study, 5 is the highest, f_i= frequency of response; and n= total number of responses (see also Holt, 2014).

5.8 QUALITATIVE ANALYSIS

The qualitative analysis was carried out hand in hand with the data collection procedure (Glesne and Peshkin, 1992). Consistently reflecting on the data and careful organisation was crucial to develop an 'after story'. A combination of thematic and content analysis was utilised with the aid of *NVivo 9* software to perform tasks such as coding and deriving nodes. It involved developing themes and categories after the initial analysis (inductive approach) (see Miles and Huberman, 1994; Tashakkori and Teddlie, 1998). The interpretation and analysis involved organising the text into chunks/categories, and then further engaging with data to describe outcomes (Creswell, 2009). This data was further developed into matrices (Bryman, 2008; Denscombe, 2010), in the form of a spreadsheet with main themes and subthemes displaying key practices and procedures.

Depending on the strategy adopted (i.e. deductive or inductive approach to qualitative analysis), applying data reduction, to transform the qualitative data into numerical form is useful (Tashakkori and Teddlie, 1998). It results in a frequency count of themes, responses, behaviours or even events (*ibid*, p.128). Preceding the data reduction, actions such as transcribing the data and further organising the data into groups or categories, which later emerge as themes, are also critical.

The specific steps undertaken included:

(i) **Initial coding (or open coding)** which involves coding as the name suggests—i.e. analysing the text. Stake (1995) was of the view that "*all research is a search for patterns, for consistencies*", while Miles and Huberman (1994) suggest that coding is analysis—i.e. "review *a set of field notes, transcribed or synthesized, and to dissect them meaningfully* […]". Consistent with these views, the coding process is a systematic step towards organising text largely influenced by the research question(s). Others have alluded to this procedure as analysis of data that has been collected in order to develop grounded theories (Flick, 2009).

(ii) **Pattern coding (or axial coding)** refers to building of patterns from the codes and labels generated after the initial coding. At this stage, Miles and Huberman (1994) emphasize the importance of structure. They suggest that codes should relate to one other in a coherent manner. It therefore becomes necessary to revise codes, restructure codes, and check the coding. This ensures that the codes link back to context, consequences, and patterns (Bryman, 2012).

(iii) **Data display (or selective coding)** means fitting the coding into the built structure after the two preceding steps are complete. It is advisable that the built structure must relate to other segments in a meaningful way, as such helps to define, store, and display the codes into systematic structures (Miles and Huberman, 1994).

5.9 VALIDATION AND RELIABILITY

The research reliability and validity is often of paramount importance to largely measure whether the study meets its intended aim and objectives. Denscombe (2010) defines validity as the quality of the data and reliability, as the quality of the methods. Bryman (2008) referred to two types of validity: internal and external validity, which relate to causality and generalisation of research results, explained in detail subsequently.

5.9.1 Internal validation

Internal validity most times refers to the degree to which the outcomes of the study are trustworthy. Undertaking such a procedure requires a careful examination of inferences drawn from the study (Tashakkori and Teddlie, 1998). In quantitative studies, this largely depends on the degree of statistical control over extraneous variables, while in qualitative studies it entails confirmation of drawn conclusions by more than one method of analysis (*ibid*, p.68).

Thus, a careful audit regarding the credibility of the results is essential. Achieving of such an audit requires first, a critical inspection of the results in terms of consistency with the aim and objectives. Second, it entails carefully drawing valid inferences from the data. As such, in line with checking internal validity, performing external validity is also critical. Given such an association, it is clear that the two are complementary in this respect, rather than mutually exclusive. Additionally, Bryman (2012) suggests that internal validity often refers to the extent to which observations made by the researcher match the theory developed. However, for purposes of external validity, a remedial action framework is evaluated as discussed in Section 5.9.2 (see Chapter 8).

5.9.2 External validation

Based on the developed remedial action framework, questions evaluating the remedial actions and change drivers are included in the research report (see Appendix 5). Bryman (2012) explains that external validity refers to the extent of generalisation of the conclusions drawn. This is partly also met by the fact that the sampling frames are drawn from reliable sources. As such, it is reasonable to argue that the developed framework is practical, evident from the feedback obtained as discussed in Chapter 9 (see Section 9.1.1).

5.9.3 Reliability

Unsurprisingly, one of the main concerns of quantitative research is the reliability of the data collection strategy. Although this is of a lesser concern in qualitative studies (Tashakkori and Teddlie, 1998), undertaking careful steps towards determining the reliability of the results remain paramount. Bryman (2012) describes this procedure in the form of both internal and external. Internal, relating to whether other research team members agree with the findings and external in terms of the extent to which the study results are replicable. Field (2009) on the other hand defines reliability as "the ability of a measure to produce consistent results when the same entities are measured under different conditions". Statistically, a measure known as the Cronbach's alpha is the most common measure of reliability (Field, 2009). Its main aim is to measure the reliability of a scale. Deriving the Cronbach's alpha is calculated as depicted in equation 5.8:

$$\propto = \frac{N^2\,\overline{Cov}}{\sum S_{item}^2 + \sum Cov_{item}} \qquad (\textit{Equation 5.8})$$

Where,

N^2 = number of items squared

$\overline{Cov}$ = average covariance between items

S^2 = item variances

Cov = item covariances.

However, its application largely complements statistical tests such as Principal Component Analysis (PCA), as such not employed in this study.

Additionally, to measure the agreement rate, Kendall's coefficient of concordance (*W*) is widely acknowledged (e.g. Siegel and Castellan, 1988). It is given as follows:

$$W = \frac{12 \sum R_i^2 - 3k^2 N(N+1)^2}{k^2 N(N^2-1) - k \sum T_j} \qquad (\textit{Equation 5.9})$$

Where,

$12 \sum R_i^2$ is the sum of the squared sums of ranks for each of the *N* objects being ranked; *k* refers to the number of sets of rankings; and T_j is the correction factor.

5.10 LIMITATIONS OF THE RESEARCH DESIGN APPROACH

The use of interviews entailed using a small sample, of which the obtained results were not generalizable, but rather complements the two surveys undertaken and informs the remedial action framework. The results from the interviews are thus transferable in this regard. In addition, given that, it was only practically possible to collect data from three major stakeholders involved in the implementation of the CDM Regulations; the findings of this study may not necessarily reflect the views of Clients and Contractors, including those that are self-employed. Further, it is also reasonable to suggest that because of the nature of the problem identified, investigating the implementation of the CDM Regulations through case studies was a viable alternative. However, time constraints, project accessibility, and confidentiality issues were an impediment to case studies. Initially it was envisaged that obtaining project information through the F10 form (i.e. HSE project notification database) was viable; conversely proved otherwise, despite numerous efforts made in this regard.

5.11 CHAPTER SUMMARY

This chapter introduces the research design adopted for this study. It describes the underlying philosophical assumptions within the context of this study. A discussion regarding the two main research strategies is provided, after which it describes the adopted research design. Whilst offering a thorough discussion identifying the adopted approach, an indication of alternative approaches is put forward. Key features of the research design are identified, discussing among other things the data collection procedure, after which the rationale for undertaking such methods is explained. It advocates for a mixed methods approach; largely influenced by the research questions and the nature of the problem.

The validity and reliability of the study is further discussed, detailing practical steps undertaken. It is also clear that there are limitations because of adopting the research design of this study. Further, constraints regarding adopting an alternative research design are discussed in detail. Having provided a thorough discussion concerning the research design strategy, Chapter 6 discusses findings from the interviews.

CHAPTER 6: DATA ANALYSIS AND DISCUSSION: THE DESIGNER DUTY HOLDER

6.0 INTRODUCTION

This chapter examines the discharge of duties pertaining to the role of the Designer in the context of the CDM Regulations as explained in Chapter 4. The chapter begins by determining the extent of awareness of duties imposed on the Designer. It then elaborates on the practical steps taken to discharge duties of the Designer. The last section discusses the implications of these findings towards improved CDM implementation. The chapter contributes to knowledge by describing practices relating to the discharge of duties of the Designer in the context of the CDM 2007, thus partially meeting the fourth objective of the study.

6.1 AWARENESS OF DUTIES OF THE DESIGNER UNDER THE CONSTRUCTION (DESIGN AND MANAGEMENT) REGULATIONS 2007

Whilst some authors have confined the design practitioner to normally be a person trained with design expertise (see e.g. Toole, 2002; Horne *et al.*, 2003), it has been acknowledged on many other occasions that the Designer is more broadly defined in the context of the CDM 2007 (e.g. CIRIA, 2007; Oloke, 2010; Lingard *et al.*, 2011). For example, the CIRIA (2007a) points out that the Designer under the CDM has a broad meaning beyond the conventional understanding and definition. The European Commission (2011) defined the Designer as a stakeholder involved in the decision making process of the design. They further clarify this by suggesting that (p.84):

> *It is not only the typical designers such as architects, civil and structural engineers who take design decisions. There are often other specialists, and also designers including mechanical and electrical services, lifts, cladding, and others who are design, supply and fit specialists and also temporary works designers.*

This is consistent with the definition provided in the CDM 2007. It defines the Designer as:

> *...a person (including a client, contractor or other person referred to in these Regulations) who in the course of furtherance of a business—(a) prepares or modifies a design; or (b) arranges for or instructs any person under his control to do so*…[Regulation 2(1)(b)].

The role of the Designer is examined in the context of CDM 2007 by considering current practices associated with the discharge of their duties based on data elicited through six in-depth interviews with Designers. All interviewees indicated that they were fully aware of their duties in the capacity of Designer. As was evident from their profiles (see Section 6.1.1), they were knowledgeable about CDM implementation. It can even be argued that given their years of experience, they were familiar with both CDM 1994 and CDM 2007.

6.1.1 Professional profiles of Designers

Given the broad definition of the Designer (see Regulation 2(1)(b)), it was crucial to examine the professional profiles of the Designers interviewed to ensure that they all fitted into the CDM definition of a Designer, and were all experienced and competent enough to provide deep insight into the CDM Designer's role.

Based on a standard framework for competence assessment outlined in the ACoP (L144) and the industry guidance (CITB, 2007a) (see Table 6.1) which is supported by Carpenter (2006b) and Oloke (2013), the examination of the Designer's profiles focussed on individual experience and professional institution membership.

Table 6.1: Determining the competence of the Designer

Determining competence of an individual designer: the two stage approach (ACoP Paragraph 213 – 225)	
Stage 1 (competency education and training)	**Stage 2** (competency experience)
This will normally be demonstrated by either:	This will normally be demonstrated by, for example:
• membership of a design-related institution, which adequately requires and examines skills and knowledge in this area	• membership of institutions which require ongoing validation of experience and knowledge
• an individual assessment for those who are not members of any recognised body	• membership of specialist registers which require ongoing validation of experience and knowledge
In this case, the criteria set by the relevant professional institution for the discipline involved will give a good basis for assessment.	• individual experience assessment.

Source: CITB (2007a)

As shown in Table 6.2, experience in years ranged between 24 and 40. Further, all interviewees were professional Designers from the civil engineering, electrical engineering and architecture disciplines. Five of the six interviewees were professionally qualified chartered members of the Institution of Civil Engineers' (ICE) H&S register and one was a member of the Association of Project Safety (APS) and the Royal Institute of British Architects (RIBA). They all occupied senior positions within their respective organisations, thus suggesting familiarity with the operations of their respective firms.

Table 6.2: Profiles of interviewees (appointed in the role of Designer)

Interviewee	**Professional Background**	**Position in Organisation**	**Professional membership**	***Size and type of Organisation**	**Years of experience**
One (ID 1)	Architect	Associate	RIBA, APS	Large (Architectural Practice)	32
Two (ID 2)	Electrical Engineer	Head of Safety	Chartered Engineer	Large (Multidisciplinary)	24
Three (ID 3)	Civil Engineer	Principal Consultant	Chartered Engineer	Small (Civil/Structural Engineering Practice)	24
Four (ID 4)	Civil Engineer	Director	Chartered Engineer	Medium (Civil/Structural Engineering Practice)	40
Five (ID 5)	Civil Engineer	Principal Associate	Chartered Engineer	Large (Civil/Structural Engineering Practice)	38
Six (ID 6)	Civil Engineer	Director	Chartered Engineer	Small (Civil/Structural Engineering Practice)	40

(*Size of firm determined by the number of employees (i.e. small > 50, medium >250, large ≤ 250).

It can be inferred from all the foregoing that interviewees are all experienced and competent, and were thus able to provide reliable data in response to the interview questions.

6.2 DISCHARGE OF DUTIES OF THE DESIGNER

The discharge of duties by Designers is often perceived as effective when considered to be proportionate to the risks and size of a specific project, rather than in a generic manner (see e.g. Bennett and Gilbertson, 2006). A plethora of industry published guidance on the role of the Designer supports this view (e.g. CIRIA, 2007; CITB, 2007a) thereby suggesting that there is need for a Designer to discharge duties in a way that is proportional to the project being undertaken and the inherent level of risk to be considered. Interviewees ID1, ID3, ID5, and ID6 were generally aware of this issue of proportionality. However, they also considered design aesthetics and precedence as critical. For example, Interviewee ID1 emphasised that as Designers they work by precedence and they have developed knowledge on what can be considered as proportionality in their design. Consistent with this view, interviewee ID4 made a comment that:

> […] *if it's not practical to build that's when it can get dangerous to build…we've always tried to work out designs that are practical and straightforward to build…based on established techniques…*[ID4].

Achieving this requires addressing the perceived H&S challenges in the design as suggested by various industry guidance (e.g. CIRIA, 2007; CITB, 2007a; ICE, 2010). It is within this context that the interviewees were asked to explain the practical steps taken to design out risk in line with Regulations 11(2), 11(3), 11(4) and 11(5); and comply with 11(6), 18(1), and 18(2).

6.2.1 Discharge of duty to avoid foreseeable risk (Regulations 11(2) and 11(3))

The importance of the role played by the Designer towards designing out foreseeable risk, has been established on numerous occasions (e.g. Gambatese and Hinze, 1999; CITB, 2007a). In practice however, it was established that there are discrepancies in the discharge of this duty as illustrated subsequently. For example, interviewee ID1 explained that analysis of hazards was critical towards avoiding foreseeable risks as noted below:

> *We analyse, identify hazards, analyse if there are any unusual or hidden ones that would not be obvious to a contractor and then we look at how to design them out, or perhaps design something that can be managed.*

Indeed, it is reasonable to suggest that such an approach, which is proactive rather than reactive, is commendable. The Designers' guidance document prepared by the CITB (CITB, 2007a), suggests first undertaking the design decision in terms of proportion. To achieve proportionality, the guidance document recommends integrating hazard elimination and risk reduction earlier in the design process (CITB, 2007a, p.15). In this way, design decisions taken upfront or during the early design phase reduce the occurrence of risks. Practical steps taken when considering proportionality were expressed in the following manner:

> *I check through the project from all aspects as well as CDM, so we check through everything; but obviously as you know Architects work by precedent, we've done a lot of things before, we know what can be done and we have a team of people that do them, so we are really looking for the unusual and issues that have not been dealt with before* [ID1].

> *…we have a visual record of what we are doing, which we keep in parallel with the scheme analysis drawings, which I use as CDM-C and projects which I'm not CDM-C on, to actually say what the reasons for doing things are given to some extent, not on everything, only what is perceived unusual and not on every risk issue. For instance, it can be a difficult asbestos issue, things of that sort of nature, and then we record that for the benefit of the future…* [ID6].

Further, it was observed that because of already established construction techniques, methods and design precedence, some of the interviewees stated that they were only compelled to address unusual hazards rather than obvious ones, as demonstrated in the comment above. Moreover, it was also expressed that a competent contractor had the capacity to deal with any foreseeable hazards. Where information was insufficient on the drawings, it was considered good practice to notify the Designer. For example, interviewee ID4 made the following comment:

> *…so we take the view that clear drawings are good practical designs and we put a note on all drawings to say to the contractor that if there is anything that he is not sure about or if he does not feel his got the information to be able to safely build the job, he should contact us; that's not a get out clause its meant as a straight question, if he looks at the drawings and he doesn't understand them, or if he thinks he doesn't have the information to be able to build it safely he should contact us rather than pressing on* [ID4].

Team working was also expressed as an integral part of avoiding risks. When undertaking design reviews, interviewee ID2 confirmed this, and stated that, "we go through a number of staged reviews and at the end of the design development, contractors get involved in the review process." It was also acknowledged that the responsibility of the Designer as prescribed by the Client in the terms of engagement often dictated the extent to which this duty was discharged (ID3). Perhaps this indicates that practices associated with the duty to avoid foreseeable risk vary, depending on the expertise of the design organisation and the influence of the Client. Indeed, it was expressed on numerous occasions that the organisations discharged duties according to their level of expertise, also according to built-in frameworks that supported such efforts (e.g. ID2).

Although there are differences in the practices, the above verbatim comments from interviewees ID1, ID4, ID2 and ID6 extracted from the interviews demonstrate that Designers in most instances follow a systematic methodology to avoid foreseeable risk. For example, ensuring that they scrutinise designs for unusual hazards, team working, training and visual records were common practices. Considering the identification of unusual hazards, it was pointed out that this largely depended on the type of project, be it alterations or a complete new-build. Interviewee ID3 stated that on most refurbishment projects, they mainly considered issues such as access to the site, its conditions, and existing services, to identify hidden risks. Most importantly, it was acknowledged that once the unusual risks were identified, a record was kept for future use.

The Designer's guidance report (CITB, 2007a, p.26) on the other hand, states that "detection of hazards and risks will normally include a review of the likely construction methods, maintenance, use and decommissioning". This resonates with the perspective held by other researchers regarding designing out risks at source (e.g. Cooke *et al.*, 2009). From the discussion and interview extracts above, it can be observed that some Designers took keen interest in discharging the duty to avoid foreseeable risks and took proactive steps as suggested in the guidance document.

Even when the avoidance of foreseeable risks is for health reasons, it was perceived important to take cognizance of the design implications. As such, providing information pertaining to such risks is of paramount importance for the subsequent discharge of other duties by the other stakeholders as elaborated in Section 6.2.3.

It is therefore reasonable to state that the interviewees were largely aware of their responsibilities regarding avoiding foreseeable risks based on the foregoing. However, it is also evident that their ability to fully discharge this role was mitigated by their terms of engagement. Where their terms of engagement did not fully permit them to make a meaningful contribution to the task of risk avoidance or reduction, it was then left entirely to the contractor to manage the risks, as expressed by interviewee ID3:

> *My input usually depends on the type of build, if we are looking at say a building from a structural engineering point of view, the Architect has already set the form of structure, so if he has put a lamp at you say 20 meters high, I can only say that I'll provide the beam to hold it up and flag it up, that, they should look at it, but I can't change it at that stage, because he* [the Architect] *must have discussed this with the client and the client wants it that way* [...].

6.2.2 Discharge of duty to eliminate hazards and reduce risks (Regulations 11(4) and 11(5))

The interviewees provided examples of procedures followed within their organisations, which suggest that they largely comply with Regulations 11(4) and 11(5). Similar to the avoidance of risk, the interviewees highlighted that in most instances, particular attention is paid to the unusual hazards, which yielded uncommon risks, requiring unique solutions. On a number of occasions, interviewees referred to unusual hazards as work involving underground installations, tunnelling and so on, which give rise to unknown existing services such as water and electricity pipe work.

Further, it was also established that, because of the extensive experience from previous projects, common hazards were easier to identify, thus easily flagged up by the contractor. In the event of the unusual hazard, the practical steps taken varied. For example, according to the views of interviewee ID1, ID4, ID5, and ID6, they designed as far as was reasonably practicable by providing explicit information on the drawings pertaining to the specific hazards. Thus, replicating such information in the Construction Phase Plan was the Principal Contractor's duty (see Regulation 23(2)).

The other practical steps taken to eliminate hazards included initially identifying the impact on the design and subsequent construction methods. As such, particular attention was paid to the existing features around the site such as services, access, and surrounding buildings (ID2, ID3, and ID6). The consensus reached was that it was common for some of these unusual hazards to be addressed by other experts within the project team. For example, when considering design aspects that involved working from heights, it was common to consult other Designers in order to eliminate hazards that arose from such work (ID3). However, where a design was considerably in its advanced stages and involved multiple Designers, it was considered difficult to provide alterations. This was a common outcome particularly when an agreement had already been reached between the lead Designer and the Client in terms of detailed designs.

Where a design alteration was feasible, issues such as 'practicality', 'constructability', and 'buildability' were also considered. Particular attention was paid to accessibility of existing services and their location. Without full knowledge of the whereabouts of existing services, it was difficult to eliminate hazards. Some Designers acknowledged that such unknown services, would not only pose a danger to the health and safety of workers, but also considerably delayed the project. Practically, it entailed reviewing the design, while considering the implications of alternative designs. As such, the practicality of a design implies that Designers remain accountable for their design decisions. Failure to account for design decisions may result in prosecution.

Most importantly, the consensus on the issue of procedures followed towards eliminating hazards indicates that the project type and complexity often dictated the steps to be taken. As noted from the verbatim responses, the Designers interviewed remarked that all projects had to be treated differently, on their own merits (e.g. ID2, ID3, and ID6).

To sum up, it can be concluded that it was common for the Designers to undertake design development stage reviews as alluded to by interviewees ID3, ID4, ID5 and ID6 when eliminating risks. During the design development stage reviews, it was expected that contractors would get involved as well as other specialist teams. This collaborative approach, which not only involves the contractor, but also incorporates other project members and expertise such as the Client and so on, reinforces the commitment to eliminate hazards and secure the health and safety of workers on site.

6.2.3 Discharge of duty to provide design sufficient information (Regulation 11(6))

It was expressed in the previous sections that critical information had to be passed on to other project team members having identified ways of avoiding risks and eliminating hazards. Such information is useful in support of managing risks pertaining to a specific activity on site. Furthermore, despite the expectation on the Designer to produce many aspects of the design and instruct various duty holders, the consensus view of Designers was that other duty holders were also experts. It was therefore not entirely the duty of the Designer to ensure that all aspects of the design are dealt with. It was acknowledged by one interviewee that "...generally anything to do with construction information is passed on and if there is any complex issue such as demolition, cantilevers or pre-stressed members, this is generally beyond our expertise" (ID6). Regardless of this, it is still of paramount importance for the Designer to provide design information that is sufficient, to assist other project team members make informed decisions.

Approaches towards provision of sufficient information are expressed as detailed in Table 6.3. Some of the practices, which were commonplace, include *inter alia*: (a) inserting notes on drawings, (b) passing on the responsibility to other experts, (c) providing a list of specific instructions, and (d) senior staff checking of drawings.

Table 6.3: Information conveyed on the produced working drawings

Comment	Professional practice/discipline
"Once we have developed the design, normally it's not advised to just put very basic information otherwise you have a whole load of things on a drawing that are not necessary, so if they are unique, let's say very unique; structural elements like steel beams that are very heavy covering a long span, we tend to put a note to consider the methods that should be used to lift and install; however there are standard procedures for many of them, but there might be times that you just want to put a note, especially if they are going into a space that is very unusual [ID3]."	Civil and Structural engineering
"…we pass on the issues to the contractor to deal with. If you design as far as you can, we pass that on to them for their information, and then it is up to them as to how they implement the safety issues in relation to that. The only time we get involved again is if they want to change the design again, the fact is they are the experts, we leave it up to them and the intention is for them to deliver what we have designed [ID6]."	Civil Engineering
"…it could be something like the method of cleaning windows, the method of accessing a roof, those are the issues which are going to be [provided]; the cleaning and maintenance strategy you know, in relation to the architecture…[ID1]."	Architecture
"…there are various initiatives about including specific safety advise on the drawings…what we have introduced is a drag list, which is railway specific and incorporates a red, amber, green list…[ID2]."	Civil engineering
"…we wish it to be very specific and really focused on significant and unusual hazards on the basis that we employ very very competent contractors […] so the way we incorporate that information [is] within the design drawings themselves…[ID3]."	Civil engineering
"…if the design has any major risks, that would be obvious to an experienced contractor, that in practice almost certainly means that there's something wrong with our drawings, so we change our drawings and make them clearer and basically we take the view that if our drawing is clear, if the risk isn't obvious to the contractor, then it sends us a signal that what's required hasn't been drawn clearly enough on the drawing, because if it was drawn clearly then any risks which should be obvious to him…[ID5]"	Civil engineering
"…so our procedure is, when we are checking drawings for construction, a senior member of staff looks over the drawings, to see if there any, anything major we think up as being a major risk that wouldn't be obvious and if there is, he says, well is there a way we can get rid of that risk, or the problem is that the drawing is not good, in which case the drawing is improved, so if the risk can be removed, its removed or if the drawing is not clear enough […] the drawing is made clearer so that the risk becomes obvious and we take the view that provided we go through that process they shouldn't be any need for special notes normally…[ID4]"	Civil engineering

These verbatim comments relating to the information provision to design out risk sum up the suggestion that the onus lies on the all stakeholders given their different expertise. Based on the comments and emerging themes, it can be argued that provision of information is therefore subjective and largely depends on the competence or expertise of the team involved. As far as Designers are concerned, there is a need to provide clear drawings and further design information that is sufficient to enable other stakeholders discharge their own responsibilities, particularly where unusual hazards are evident. From the data collected, it is reasonable to conclude that currently there is a tendency for the design practitioners to provide information relating to identified risks, particularly in the event of unusual hazards. A consensus reached by interviewees ID1, ID3, ID5 and ID6 was that only the most critical information was conveyed on the drawings, rather than filling the drawings with unnecessary notes.

6.2.4 Discharge of duty to ensure CDM-C appointment (Regulation 18(1))

Designers are required to ensure that before undertaking any detailed design, the CDM-C is appointed (Regulation 18(1)). In this regard, interviewees were asked to explain whether they ensure that the CDM-C is appointed. The views provided by the interviewees seem to suggest that the appointment of an independent CDM-C was of no consequence to H&S management at the design stage because of their reactive nature or lack of involvement. It is because of the tendency to take on the dual role that Designers see no value in having an independent CDM-C as confirmed by three of the six interviewees (i.e. ID1, ID3, and ID6) below:

> *…we have an in-house team that deals with CDM coordination duties. On most of our projects, the Client requires both our services as Designer and CDM-C…* [ID1].

> *… I am a trained CDM-C; as such, I can wear the hat of a CDM-C and do not usually require the input of an independently appointed CDM-C…* [ID3].

> *…we work as CDM-Cs on most projects, and we have external CDM-Cs on others, but very often no; externally they sit on their hands and ask us to do design risk assessments; they are not generally proactive and they are generally asking us to look at the issues; they are just saying what are the issues and that's why we've adopted a different approach* [ID6].

As for the other three interviewees (ID2, ID4, ID5), they were of the view that they do not ensure the appointment of the CDM-C given the ineffectiveness of the role. The consensus was that a small proportion was good, while the majority were of little use. From the experience of interviewee ID2, it was reported, "approximately 15% of the CDM-Cs were good, while the rest were of no use beyond their tick box exercise and rarely visited the site". As such, the general view of interviewees was that the current insufficient contribution of the independent CDM-C did not warrant their appointment, as demonstrated by the verbatim comment:

> *..most CDM Coordinators don't know much about design to be blunt; some of the CDM Coordinators are helpful and it depends on what they know about the job; they may know a particular aspect we are not familiar with and they can be helpful;*[however], *most CDM Coordinators on most jobs are not experienced designers…*[ID4].

Based on the discussion above, it is viable to conclude that Designers do not ensure appointment of the CDM-C. This is attributable in part to the perceived ineffectiveness of the CDM-C role due to the insufficient input received from an independently appointed CDM-C. Designers therefore take no interest in ensuring appointment of the CDM-C, as they perceive little value in that appointment. Moreover, as the Client assumes that role by default if no appointment is made (see Regulation 14(4)(a)), it is very unlikely that Designers can be charged with breach of this duty. This could be further reason for their apathy towards this duty. Given this strong perception of the ineffectiveness of this role in relation to design and the general apathy of Designers towards this duty, it raises the question of how much support they provide to the CDM-C in compliance with Regulation 18(2), to enable them discharge their other duties more effectively. The next section investigates this issue further.

6.2.5 Discharge of duty to assist the CDM-C and provide information when preparing the H&S File (Regulation 18(2))

Support from the Designer is critical for CDM-Cs to discharge their duties, more so as doubts have been raised about the expertise of CDM-Cs in relation to design matters. It is in this regard that interviewees were required to explain how they discharged this duty in practice. Occasionally, interviewees supported the CDM-C by providing information when requested. Mostly, such information was provided in support of preparing the H&S File as demonstrated by the interview extracts below:

> *...we provide all our as built drawings to the CDM-C for them to incorporate in the health and safety file which in our view is a very important document to refer to for future projects* [ID5].
>
> *...at the end of the project we just update the existing file, the files are electronic, so we don't necessarily pass on big files to the CDM-C; so when we for instance build a new bridge or a new tunnel or a new station, that information will be included within that standard process we've got already, so we don't get big files that sit on the shelf per se which we have to give to the CDM-C, all we do is update the existing data base...*[ID2].

The main practices highlighted by the interviewees suggest that they normally provide the final designs and as-built drawings, in collaboration with the contractor. Furthermore, interviewee ID3 stated that they also provided manuals for specialist designs such as mechanical and electrical fittings to assist the CDM-C and Client for future maintenance purposes. By updating the existing files electronically, information was readily accessible by CDM-Cs, enabling them to prepare the H&S File. However, despite the limited collaboration between the Designer and the CDM-C as indicated in the preceding subsection (6.2.4), there was a tendency for Designers to support the role of the CDM-C, particularly regarding preparation of the H&S File. Where the CDM-C's duties are undertaken in-house, it seems this duty is discharged more easily. In the main, provision of such information in form of final designs and as-built drawings were provided upon request; while some design organisations updated a universally accessible project database; confirming the differences in practices when supporting the CDM-C.

6.3 DISCUSSION: IMPLICATIONS OF FINDINGS

It is widely known and an accepted practice that Designers normally contribute early to projects (e.g. Bennett and Gilbertson, 2006; Clark, 2011). Other researchers have described this involvement of Designers as instrumental in the successful delivery of projects, given the influence of design decisions for the wellbeing of all workers (e.g. Bennett and Gilbertson, 2006, pg. 15). An extensive examination of the extent to which Designers discharge their duties reveals that there are differences in approach mostly triggered by the type of project and complexity (see Section 6.2.2). To extend the understanding of how Designers discharge their duties in the context of the CDM 2007, this section discusses the implications of the findings. It refers to the CIRIA model, which is an industry-developed guide to control hazards at various design stages (see Figure 6.1).

6.3.1 Practices associated with avoiding, reducing and eliminating risks and hazards

The primary data relating to the discharge of designing out risk provides compelling evidence of the advantages of discharging this duty. After identifying the hazard, the four actions that follow (avoidance, reduction, control and inform) shown in the CIRIA model reflect the practices of the interviewees. This shows some compliance with the requirements of Regulations 11(3) and 11(4). However, the extent of compliance has been questioned by other duty holders who express concern that not enough is done by Designers to avoid, reduce or eliminate risks. A Principal Contractor (PC) was of the view that:

> *Designers still fail to consider the building cycle at the use or maintenance stage. The number of access hazards and risks for engineers is still too high in*

> *some builds; designers need to be more accountable and maybe even provided with safety training.* [PC Respondent 63].

This may indicate that there is still considerable scope to improve the discharge of these duties in a manner that is proportionate to the inherent risks. During the design stage, Designers should anticipate the implications of their design decisions. As such, establishing control measures during design, which reflect proportionality in terms of identifying specific risks and mitigation strategies is essential. In other words, ensuring Designers are adequately resourced in a proportional manner to avoid, reduce, and eliminate the risks involved is critical.

6.3.2 Practices associated with providing design sufficient information

Providing design sufficient information is central to eliminating or reducing risks and hazards. As demonstrated previously, information relayed has a direct impact on the safety of workers. However, the evidence shows that the practices regarding provision of such information differ. Where duties of the CDM-C are discharged in-house, the information from the Designer was easily accessible. However, where an independent CDM-C was appointed, the tendency was for Designers to provide the final designs and as-built drawings mainly upon request. Moreover, it was noted that there tended to be collaboration challenges between an independent CDM-C and the Designer, as acknowledged by one Principal Contractor:

> *the CDM-C and Designer need to cooperate better with the PC when providing information, and buildability issues need to be tackled at the main working drawing/design stage* [PC Respondent 32].

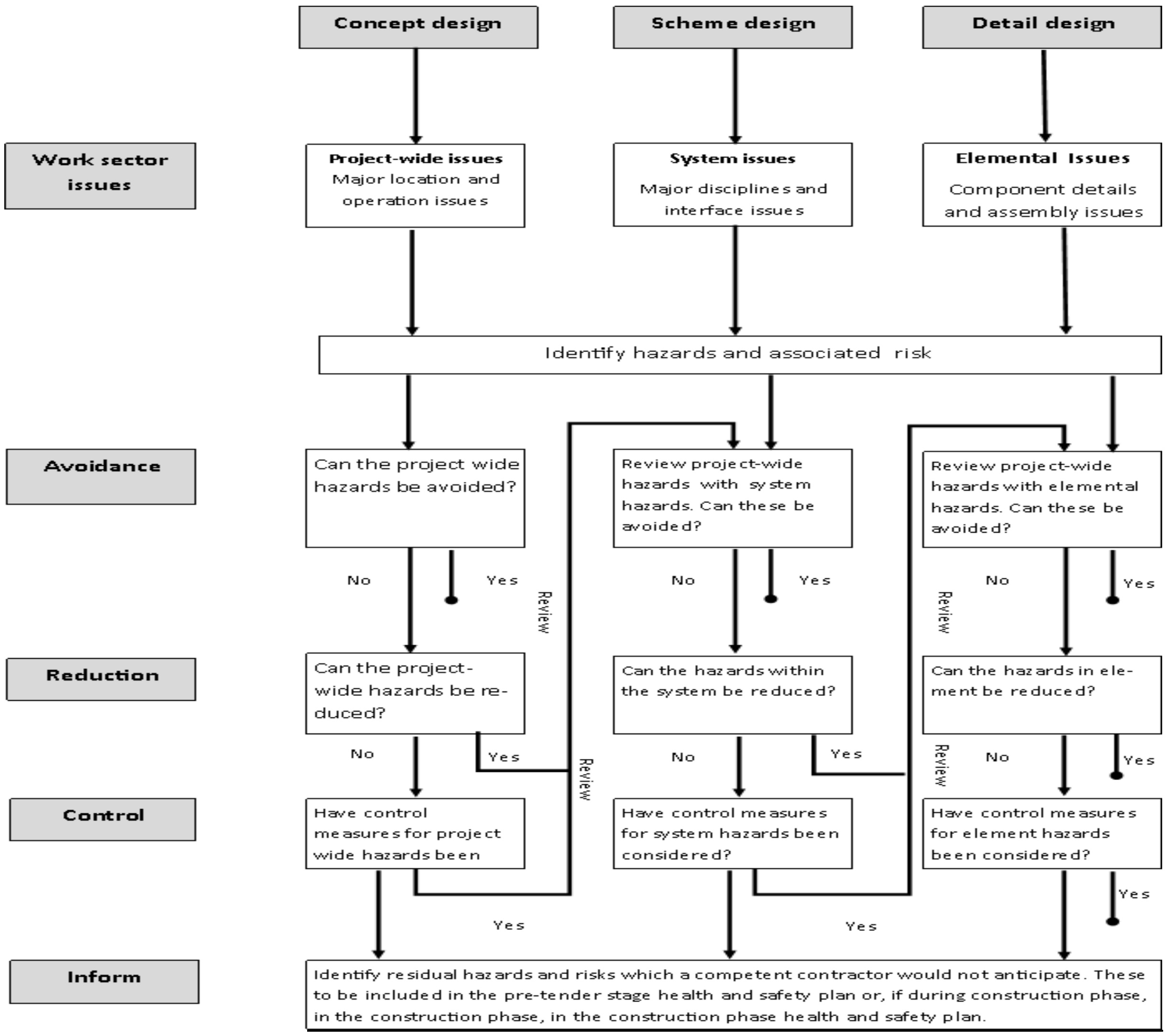

Figure 6.1: Flowchart of hazard analysis (Source: CIRIA, 2007)

Considering the CIRIA model, it is clear that information, which is not obvious to a competent contractor, needs to be conveyed. It was found that the provision of design sufficient information was largely driven by the identification of unusual hazards rather than the obvious ones. This was based on the argument made by interviewees that in the case of obvious risks and hazards, contractors were competent enough to identify and deal with them. The most common method of provision of information was on the drawings themselves. However, to identify what constitutes provision of design information that is sufficient, invites further research.

6.3.3 Commencing work after the appointment of the CDM-C

Despite numerous articles indicating that early appointment of the CDM-C is beneficial (see e.g. Scopes, 2009a; Shiplee *et al.*, 2011), it was revealed that Designers commenced work largely before the appointment of the CDM-C. Surprisingly, this failure did not seem to concern the Designers. There was unanimity in the view that independent CDM-Cs have limited design expertise as expressed by interviewee ID4:

> *...the regulations assume that CDM-Cs can give us lots of help, but the reality is that they are not experienced designers, they are just a nuisance, most of them are not even familiar with the regulations* [...].

Given the perception that limited input is received from an independent CDM-C as demonstrated in Section 6.2.4, Designers were compelled to commence detailed design work even before the appointment of the CDM-C. Moreover, this outcome can be attributed in part due to the late stage of appointment of CDM-Cs (see Section 7.3.1). Contrary to this general view, two interviewees (ID2 and ID3) stated that it was good practice to receive input from an independently appointed CDM-C before they commenced with their design, given that CDM-Cs are privy to certain information useful to the Designer. Interviewee ID3 provided a comment on this issue:

> *...the CDM-Cs have the privilege of having all the design data with them, from the Architect, from the Clients' brief right through to the M&E designers and everybody else, so from that perspective we are not sure how certain things will interface after our design, it might be good to ask them, if they have any information from the, you know other members of the team that can help, even though that must have been made available to us, but there might be some salient details that are not obvious so that's when we might need them* [...].

This contradiction with earlier comments is startling, on one hand it was conceived that an independent CDM-C had little to offer, while on the other, acknowledged that their input was crucial. What clearly emerges however is the tendency for the Designer to commence work before the appointment of the CDM-C, which indeed raises questions about the ability of the CDM-C to influence decisions made in the early stage of design. On many complex and high profile projects such as the London 2012 project, it appears a conscious effort is made to ensure early appointment and subsequent input of the CDM-C (e.g. Scopes, 2009b; Webster, 2013) suggesting that perhaps issues such as, project complexity and size may largely influence the discharge of this duty. Whatever the case though, the Client by default performs the role of the CDM-C until such a time when the CDM-C is appointed (see Regulation 14(4)). Meaning that there can be no breach of this provision and there is no incentive for Designers to act. This insight invites further research to establish how widespread this practice is or whether Designers ensure the appointment of a CDM-C.

6.3.4 Practices associated with assisting the CDM-C

Once a project is identified as notifiable, appointment of the CDM-C is expected to follow. Crucially, the CDM-C is not expected to work in isolation given that the role largely entails coordinating various H&S aspects of the project. It is therefore against this backdrop that the Designer supports the CDM-C to comply with their duties. Additionally, since the Designer is expected to provide design sufficient information to the CDM-C as well as the other duty holders, it is reasonable to conclude that the timely provision of such information is critical for the CDM-C to perform.

From the interviews, it was revealed that most Designers were approached by the CDM-C to provide them with information pertaining to risk elimination or reduction and indeed project drawings to form part of the H&S File. In this way, discharging Regulation 18(2) by the Designer complements the work of the CDM-C. Doubts are however raised about whether CDM-Cs play a useful role during the early design phase and subsequent development of the H&S File, besides simply compiling the project information from the Designer. Interviewee ID6 expressed this view in the following manner:

> *I have come across jobs were the CDM Coordinator says send me the drawings and then I will issue them to everybody else, and it's just hopeless because it slows communication down and interferes with the process, that bit is terrible to conceive and I don't see how the role can work.*

The arguments put across in the preceding section seem to suggest that the issue is not with the duty of the Designer to provide information required by the CDM-C; rather, the issue is with the underlying challenges of collaboration and cooperation between the CDM-C and the Designer. Most importantly, this outcome questions the effectiveness of both roles, given that there is need for the CDM-C and Designer to discharge duties in a complementary manner.

6.4 CHAPTER SUMMARY

This chapter sheds light on the practices followed by Designers to discharge their duties. It shows that the extent to which such duties are performed varies. Identification of unusual hazards rather than common ones is critical; of which this information is then passed on to the other duty holders. There is evidence that the Designer in some instances performs the dual role of CDM-C and Designer. However, the effectiveness of undertaking a dual role is questionable. Moreover, it was perceived that the Designer was inadequately trained to perform the duties of a CDM-C on several occasions (e.g. CDM-C Respondent 22).

There are differences in practices to discharge duties of the Designer in the context of CDM 2007. The results also highlight that there are collaboration challenges between an independent CDM-C and the Designer. This outcome invites the need to investigate the extent to which duties of the CDM-C and PC are discharged. Moreover, the appointment of these two duty holders suggests that the CDM Regulations fully apply (see Regulation 3(3)(a)). As such, two surveys were undertaken concurrently; results of which are reported in Chapter 7.

CHAPTER 7: DATA ANALYSIS AND DISCUSSION: THE CDM-C AND PC DUTY HOLDERS

7.0 INTRODUCTION

The preceding chapter examined the duties of the Designer as implemented in practice. This chapter seeks to extend this insight by focussing on the duties of the CDM-C and PC. It begins by shedding light on the professional profiles of the CDM-Cs and PCs who partook in the surveys. Further, it discusses the appointment stage of these duty holders (see Regulation 14) and examines other critical demographic data with the use of descriptive statistics. This chapter also partially meets the fourth objective of the study, which was: to collect primary data from key CDM stakeholders; examine the discharge of duties; and identify practices and deficiencies associated with these obligations.

7.1 AN OVERVIEW OF THE QUANTITATIVE EMPIRICAL RESULTS

The empirical results collected by means of two postal surveys undertaken concurrently, are presented and discussed in this chapter. Part of the literature review outlining CDM implementation challenges (see Chapter 4), informs the basis for undertaking the surveys. This decision thus underpins the choice of methods utilised to answer the research questions as suggested in the research design chapter (see Chapter 5). The results reported in this chapter refer to respondents appointed in the role of the CDM-C and PC.

This chapter seeks to establish current practices towards compliance with the CDM regulations; and identify duties discharged in practice that invite improvement. This is in line with the fourth objective of this study; subsequently informing the development of a remedial action framework (see Chapter 8). The fieldwork, undertaken concurrently, was preceded by the pilot phase as discussed in the research design chapter. It involved designing the research instrument; pretesting; adjusting the research instrument based on the pilot feedback; and embarking on the fieldwork. As such, primary data was collected using pretested coherent research instruments, largely informed by the extant body of knowledge within the context of implementing the CDM Regulations, and at the same time guided by the aim and objectives of the study.

7.2 DEMOGRAPHIC INFORMATION OF THE RESPONDENTS: FINDINGS AND DISCUSSION

The duration of a project's construction phase or the number of person days involved prompts the need for appointment of the CDM-C (Regulation 14(1)) and PC (Regulation 14(2)). It is the Client's obligation to make such appointments when a project is deemed notifiable to the HSE or Office of Rail Regulation (ORR) (see Regulation (2)(3)). The Client must therefore comply by appointing the CDM-C in the first instance to ensure that notice is given to the HSE (or ORR) (Regulation 21(1)). Giving of notice to the relevant authorities subsequently follows the appointment of the PC, preferably before the start of construction work (Regulation 21(2)). Omitting the appointment of one or both of these duty holders leaves the Client accountable for the discharge of duties of the PCs and CDM-Cs (Regulation 14(4)(a) and 14(4)(b)). The appointment of these two duty holders not only demands of the Client to check their competence, but similarly those appointed must not accept such an appointment if incompetent. By virtue of appointing these duty holders, it is clear that the Client has an important duty in competence checking. Regulation 4 stipulates competence requirements for those appointed under the CDM Regulations and it is within this context that the respondents were invited to provide professional background information (see Section 1.0 of the survey questionnaires—Appendix 2 and 3). Considering the guidance in the ACoP (see paragraph 195 to 205 of the ACoP), data were sought for the following factors:

(i) position in the organisation

(ii) professional background

(iii) years of experience in the position

(iv) years of experience in the construction industry; and

(v) professional certification and accreditation.

Descriptive statistics was used to explore the demographic data to gain an overview of the professional backgrounds of duty holders and appreciate the level of competence they bring to their roles.

7.2.1 Profile of CDM-Cs

Table 7.1 shows that over 50% of the respondents appointed in the role of CDM-C held the position of Director in their organisations; 29.2% indicated that they fulfilled the role of Senior CDM-C and 14.6% represents the portion of those in the position of CDM-C. While one of the respondents did not specify the position held, another indicated to be a Designer.

Table 7.1: Position in organisation (CDM-C)

Position in organisation	Respondents	%
Director	25	52.1
Senior CDM Coordinator	14	29.2
CDM Coordinator	7	14.6
Other	1	2.1
Unspecified	1	2.1
Total	**48**	**100**

Source: Fieldwork by author

Table 7.2 shows the years of experience and the years in position arranged according to the frequency in a stem and leaf plot style. The first row means that one respondent had 7 years of experience in the construction industry. However, the majority of the respondents had 30 to 40 years' experience, indicating a pattern in the experience of the respondents, given the centrality of highest frequency. As for years of experience in position, the majority of the respondents had between 10 to 20 years' experience. This demonstrates to some extent a high level of awareness of the respondents' CDM implementation knowledge in practice. As such, it can be argued that they are knowledgeable on CDM issues, both under the current CDM 2007 and previous CDM 1994 regime. Based on this, it is assumed that their views are credible.

Table 7.2: Stem and leaf plot (Years of experience – CDM-C)

Number	Years of experience in the construction industry	Summary (Frequency)	
0	7	< 10 years	1
1	2,3,4,4,5,5,5,5	>10 < 20 years	8
2	0,3,5,5,5,5,6,8,8,8	≥ 20 < 30 years	10
3	0,0,0,0,0,0,1,3,3,5,5,5,6,7,7	≥ 30 < 40 years	15
4	0,0,0,2,3,4,5,5,8	≥ 40 < 50 years	9
5	0,0,1	≥ 50 < 55 years	3
Range/Mean	(51-7) 44/ 30.21	Total	46
Number	**Years of experience in position held**	**Summary (Frequency)**	
0	2,2,5,5,5,6,6,8,9	< 10 years	9
1	0,0,0,0,0,0,0,0,1,2,3,3,5,5,5,5,5,5,6,6,6,7,8,8,8,8,8	≥ 10 < 20 years	27
2	0,0,0,0,6,8	≥ 20 < 30 years	6
3	0,5	≥ 30 < 40 years	2
Range/Mean	(35-2) 33/ 13.28	Total	44

Source: Fieldwork by author

Further, Table 7.3 shows the professional background of the CDM-C duty holders sampled. Crucially, an examination of the professional profiles of the respondents indicates that less than half originate from a design background (i.e. Architectural, 25% and Engineering, 18.8%). This indeed is surprising given the importance placed on the role to contribute towards design decisions (e.g. Scopes, 2009a,b; Shiplee *et al.*, 2011).

Table 7.4 on the other hand sets out the professional affiliation of the participants. Determining their professional affiliation provides an indication of their level of competence, as clearly stipulated in Regulation 4. Baxendale and Jones (2000) also recognised gained knowledge in the area of H&S relative to the construction industry and evidence of qualifications in occupational H&S *inter alia*, as a means to measure competence. Further support for this view can be seen in Hare and Cameron (2011), which argues that training and qualifications are a key reflection of one's competence.

In this regard, the membership of CDM-Cs of professional bodies such as the APS (69%) and IOSH (42%) provides ample evidence of a high degree of H&S competence among the sample. Their professional affiliations also resonate with and demonstrate the appropriateness of the developed sampling frame (e.g. Anderson, 2010).

Table 7.3: Professional background (CDM-C)

Professional background	Respondents	%
Architecture	12	25
Surveying	11	22.9
Engineering	9	18.8
Other	9	18.8
Health and Safety management	7	14.6
Total	**48**	**100**

Source: Fieldwork by author

Table 7.4: Professional membership (CDM-C)

Professional body	Membership (%)	Professional body	Membership (%)
APS	33 (69)	IMechE	1 (2.1)
IOSH	20 (42)	RSPH	1 (2.1)
CIOB	9 (19)	AIA	1 (2.1)
RICS	9 (19)	CSD	1 (2.1)
IIRSM	7 (15)	RSA	1 (2.1)
ICS	6 (13)	IfireE	1 (2.1)
ICE	6 (13)	NRAC	1 (2.1)
RIBA	5 (10)	CIBSE	1 (2.1)
CIAT	3 (6)	ARB	1 (2.1)
FPWS	3 (6)		

Source: Fieldwork by author

It is noted however that beyond professional affiliation, paragraph 194 and 195 of the ACoP identifies the need for the assessment of competence to be in line with explicit project particulars, and stipulates that:

> *To be competent, an organisation or individual must have:*
> *(a) sufficient knowledge of the specific tasks to be undertaken and the risks, which the work will entail;*
> *(b) sufficient experience and ability to carry out their duties in relation to the project; to recognise their limitations and take appropriate action in order to prevent harm to those carrying out construction work, or those affected by the work.*

Combined with the professional background and years of experience, it is therefore reasonable to argue that these respondents were competent enough to answer the questionnaire.

7.2.2 Profile of PCs

The PC is mainly involved in managing H&S aspects during the construction phase. Appointed by the Client (Regulation 14(2)), the PC is instrumental in preparing the Construction Phase Plan (Regulation 23(1)(a)). This role requires cooperation with other duty holders (e.g. Designers, Contractors, and the CDM-C) towards compliance with Regulation 23(1)(a). Before establishing the extent of discharge of duties, the next section examines demographic information of the respondents appointed in the role of PC. Table 7.5 shows that 64.2% of the respondents are H&S Managers; 22.4% held other titles (e.g. Health and Safety Director, Health and Safety Advisor, Projects Director); 9% are Construction Managers; and only 4.5% are Project Managers. This signals that the majority of the respondents representing organisations appointed in the role of PC are familiar with H&S matters and the CDM regulations in general.

Table 7.5: Professional background (PC)

Professional discipline	Respondents	%
Health and Safety Manager	43	64.2
Other	15	22.4
Construction Manager	6	9
Project Manager	3	4.5
Total	67	100

Source: Fieldwork by author

Table 7.6: Stem and leaf plot (Years of Experience - PC)

Number	Years of experience in the construction industry	Summary (Frequency)	
0	1,5,6,7,8,8,9	< 10 years	7
1	0,4,5,5,6,6	≥ 10 < 20 years	6
2	0,0,3,3,3,4,4,5,5,5,5,5,6,7,7,7,7,7,8,8	≥ 20 < 30 years	20
3	0,0,0,0,0,0,0,0,0,1,3,5,5,5,6,7,7,7,8,9	≥ 30 < 40 years	20
4	0,0,0,0,0,2,2,3,3,4,6	≥ 40 < 50 years	11
5	0	≥ 50 years	1
Range/Mean	(50-1) 49/27.72	Total	65
Number	**Years of experience in the position**	**Summary (Frequency)**	
0	2,3,3,3,3,5,5,5,5,5,5,6,6,6,6,6,7,7,7,8	< 10 years	20
1	0,0,0,0,0,1,1,2,3,4,4,4,5,5,5,5,5,5,5,5,5,5,5,5,5,6,6,6,8,8,8,8	≥ 10 < 20 years	31
2	0,0,0,0,1,3,4,4,5,5,5,5	≥ 20 < 30 years	12
3	0,2,3	≥ 30 < 40 years	3
Range/Mean	(33-2) 31/13.77	Total	66

Source: Fieldwork by author

Taking into consideration the weighted average (i.e. overall experience (27.72) and the years of experience in position (13.77)) (see Table 7.6), it is revealed from these results that the experience of both groups of respondents is comparable. Clearly, the vast majority of respondents have considerable knowledge regarding implementation of CDM 1994 and CDM 2007 Regulations in practice.

7.3 APPOINTMENT OF DUTY HOLDERS: FINDINGS AND DISCUSSION

Provided a project is considered notifiable, the Client is obliged to appoint the CDM-C (Regulation 14(1)) and the PC (Regulation 14(2)). In an event were no such appointments are made, it is assumed that the Client will discharge the duties of the CDM-C or the PC (Regulation 14(3)).

7.3.1 Stage of appointment

It has been demonstrated on numerous occasions that early appointment of the CDM-C and PC is beneficial (e.g. Frontline Consultants, 2011; Anderson, 2011). Benefits such as early risk identification (e.g. Gilbertson *et al.*, 2007; Gilbertson *et al.*, 2011; Frontline

Consultants, 2012b), improved coordination (e.g. Shiplee *et al.*, 2011) and integrated H&S planning (e.g. Hare *et al.*, 2006; Hare and Cameron, 2012) have been noted.

Table 7.7: Appointment stage: respondents appointed in the role of CDM-C

Appointment stage	**1-highly unlikely, *n* (%)**	**2-unlikely, *n* (%)**	**Cumulative (1+2), *n* (%)**	**3-even, *n* (%)**	**4-likely, *n* (%)**	**5-highly likely, *n* (%)**	**Cumulative (4+5), *n* (%)**	**Unspecified, *n* (%)**
Preparation and brief stage	15 (31.2)	20 (41.7)	35 (72.9)	6 (12.5)	6 (12.5)	0 (0)	6 (12.5)	1 (2.1)
Concept design stage	6 (12.5)	21 (43.8)	27 (56.3)	12 (25)	7 (14.6)	2 (4.2)	9 (18.8)	0 (0)
Developed design stage	0 (0)	5 (10.4)	5 (10.4)	23 (47.9)	14 (29.2)	4 (8.3)	18 (37.5)	2 (4.2)
Technical design stage	4 (8.3)	5 (10.4)	9 (18.7)	12 (25)	19 (39.6)	7 (14.6)	26 (54.2)	1 (2.1)
Construction stage	8 (16.7)	8 (16.7)	16 (33.4)	7 (14.6)	9 (18.8)	15 (31.2)	24 (50)	1 (2.1)

Table 7.8: Appointment stage: respondents appointed in the role of PC

Appointment stage	**1-highly unlikely, *n* (%)**	**2-unlikely, *n* (%)**	**Cumulative (1+2), *n* (%)**	**3-even, *n* (%)**	**4-likely, *n* (%)**	**5-highly likely, *n* (%)**	**Cumulative (4+5), *n* (%)**	**Unspecified, *n* (%)**
Preparation and brief stage	37 (55.2)	17 (25.4)	54 (80.6)	5 (7.5)	3 (4.5)	0 (0)	3 (4.5)	5 (7.5)
Concept design stage	28 (41.8)	22 (32.8)	50 (74.6)	9 (13.4)	1 (1.5)	1 (1.5)	2 (3)	6 (9)
Developed design stage	12 (17.9)	15 (22.4)	27 (40.3)	19 (28.4)	10 (14.9)	7 (10.4)	17 (25.3)	4 (6)
Technical design stage	9 (13.4)	10 (14.9)	19 (28.3)	17 (25.4)	18 (26.9)	9 (13.4)	27 (40.3)	4 (6)
Construction stage	3 (4.5)	2 (3)	5 (7.5)	2 (3)	6 (9)	49 (73.1)	55 (82.1)	5 (7.5)

Given the importance attached to early appointment, views from the respondents regarding their appointment stage were solicited. Following the RIBA plan of work 2013, which identifies construction procurement stages—i.e. from the preparation and brief stage, to the construction stage, respondents were required to specify based on their experience, the stage of appointment. From Table 7.7, it can be seen that over 72% (i.e. 35 out of 48) of the CDM-Cs were not appointed during the preparation and brief stage in comparison to only 12.5%. Clearly, CDM-Cs are unlikely to be appointed as early, as envisaged by the CDM 2007, with as many as 54.2% of the respondents indicating that they were only likely to be appointed during the technical design stage or after.

The appointment stage of the PC shows a similar pattern to that of the CDM-C. Table 7.8 reveals that it is unlikely for at least 80.6% of the respondents to be appointed during the preparation and brief stage. The most likely stage of appointment of the PC from the data appears to be during the construction stage (i.e. 82.1%).

The above discussion suggests that both the CDM-Cs and PCs are unlikely to provide sufficient input (or any at all) during the preconstruction phase because of their late appointment, contrary to the expectations of the TMCS Directive (Article 5), the CDM 2007 as well as the accompanying guidance—ACoP. Arguably, for the PC, the stage of appointment may partly depend on the procurement route taken. Indeed, it is almost certain that a project procured by design and build will receive early design input from the main contractor (see e.g. Ndekugri and Turner, 1994; Wells and Hawkins, 2011). In addition, since there is a tendency for the main contractor to perform the role of the PC (e.g. Webster, 2013), it is reasonable to conclude that under a design and build approach, the PC is in a better position to contribute to the H&S management of a project's preconstruction phase. Unfortunately, many projects tend to be procured by traditional approaches, which are characterised by appointment of contractors well beyond the design phase. This inevitably means that there is very little scope for contractors or even CDM-Cs to participate in design decisions. From the results observed, it is plausible to argue that generally there is insufficient design input received from the additional duty holders given their late stage of appointment. To examine this issue further, the following hypotheses are derived:

> H_1: *There is no significant difference in mean scores of the appointment stage of CDM-Cs.*
>
> H_2: *There is no significant difference in mean scores of the appointment stage of PCs.*

A comparison of the differences between groups of scores, applying the non-parametric Freidman's test as explained by Pallant (2011) and Field (2013), suggests rejecting the null hypotheses, which suggests that the CDM-Cs and PCs are appointed during the early stages of design. The test thus indicates that there is a statistically significant difference across the five stages of appointment of the CDM-C (i.e. $\chi^2(4) = 47.347$, $n = 46$, $p < .05$). Similarly, the stages of appointment of the PC reveal a statistically significant difference (i.e. $\chi^2(4) = 148.308$, $n = 61$, $p < .05$). An increase in the mean rank and median also signals the late stage of appointment of both duty holders and suggests that they are unlikely to be appointed during the early stages of design (see Table 7.9a).

Table 7.9a: Appointment stage of duty holders (Comparison of scores)

Stage of appointment (CDM-C)	**Preparation and brief**	**Concept design**	**Developed design**	**Technical design**	**Construction**
Mean Rank	1.93	2.46	3.62	3.57	3.42
Median	2.00	2.00	3.00	4.00	4.00
Stage of appointment (PC)	**Preparation and brief**	**Concept design**	**Developed design**	**Technical design**	**Construction**
Mean Rank	1.81	2.05	3.10	3.52	4.52
Median	1.00	2.00	3.00	3.00	5.00

The impact of early design stage decisions is widely acknowledged as beneficial (e.g. Szymberski, 1997; Behm, 2005; Maitra, 2011; Larsen and Whyte, 2013). On this basis, it is reasonable to argue that early appointment of duty holders other than the Designer is crucial towards accident mitigation. Surprisingly, the evidence examined shows that the stage of appointment does not reflect the suggestion expressed in the literature, regulations, and the accompanying ACoP; thus encouraging a lack of collaboration. This view was also re-echoed by one of the interviewees appointed as Designer:

> *…I think they* [CDM-Cs] *need to integrate earlier in the process as a more user friendly design team member rather than one sitting on the outside poking the design team saying, have you done this, have you done that, and taking a sort of very high level approach rather being in the design team…*[ID1].

The implications for practice require little imagination given the limited input received from other duty holders during the design stage (i.e. CDM-Cs and PCs). However, the actual extent to which the appointment stage influences the subsequent discharge of duties remains unknown, as such, addressed in Sections 7.3.2 and 7.3.3.

7.3.2 Implications of the stage of appointment (CDM-C)

Early coordination involvement during the initial stages of the design is crucial as observed previously. As such, it is reasonable to argue that the subsequent discharge of duties is likely to be affected by late appointment. The TMCS Directive describes two stages of coordination of H&S – i.e. preconstruction coordination and construction phase coordination. Moreover, guidance relating to the benefits of early appointment of the CDM-C to discharge coordination duties is expressed clearly in paragraph 66 of the ACoP. Because it was anticipated that the late appointment of the CDM-C would have significant impact on the preconstruction coordination stage, respondents were asked to rate on a scale of 1 to 5 (see Table 7.9b) the extent to which the timing of appointment influences the discharge of duties. Provision of such data extends the current understanding and knowledge on the CDM Regulations given that it is clearly established from the literature review that timing of appointments is a source of concern (see Table 4.15). As such, scrutinising the influence of timing of appointment further shows that there are variances, deficiencies and implications; and reinforces the argument for early appointment of duty holders as discussed below. This section therefore partially addresses the fourth objective of the study and partly responds to research questions one and two (see Table 5.2), which consider the trends and variances of the discharge of duties and emerging deficiencies.

The results show that 75% (i.e. 36 out of 48) were of the view that late appointment of the CDM-C would have an impact on project notification (Regulation 21(1)), advising the

Client (Regulation 20(1)(a)), and facilitation of coordination (Regulation 20(1)(b)). Similarly over half (i.e. approximately 69%) indicated that the timing of appointment would have an impact on liaising with the PC (Regulation 20(1)(c)) and 71% expect facilitation of cooperation between duty holders (Regulation 20(2)(d)) to also be affected. Unsurprisingly, the timing of appointment was perceived to have minimal impact on developing the H&S File (Regulation 20(2)(e)), perhaps given that its handover is after the construction phase (see Table 7.9c).

It is therefore reasonable to argue that the foregoing demonstrates the significance of early appointment of the CDM-C for the timely execution of subsequent duties, particularly those performed during the pre-construction phase. Consistent with this conclusion, one respondent was of the opinion that the CDM-C appointment should occur during the 'feasibility design stage' [CDM-C Respondent 8], however, from their experience; this was not often the case in practice.

Table 7.9b: Perceived influence of late appointment on CDM-C duties (frequency distribution)

Reg.	1-highly unlikely, *n* (%)	2-unlikely, *n* (%)	Cumulative, *n* (%)	3-even, *n* (%)	4-likely, *n* (%)	5-highly likely, *n* (%)	Cumulative, *n* (%)
21(1)	3 (6.2)	3 (6.2)	6 (12.5)	6 (12.5)	8 (16.7)	28 (58.3)	36 (75)
20(1)(a)	0 (0)	4 (8.3)	4 (8.3)	8 (16.7)	17 (35.4)	19 (39.6)	36 (75)
20(1)(b)	0 (0)	3 (6.2)	3 (6.2)	9 (18.8)	19 (39.64)	17 (35.4)	36 (75)
20(1)(c)	1 (2.1)	6 (12.5)	7 (14.6)	8 (16.7)	19 (39.6)	14 (29.2)	33 (68.8)
20(2)(d)	1 (2.1)	3 (6.2)	4 (8.3)	10 (41.7)	20 (41.7)	14 (29.2)	34 (70.9)
20(2)(e)	8 (16.7)	14 (29.2)	22 (45.9)	12 (25)	6 (12.5)	8 (16.7)	14 (29.2)

Table 7.9c: Perceived influence of late appointment on CDM-C duties (central tendency scores)

Reg.	Description of duties	Median	Mean	Std. Dev.	R.I.
21(1)	Ensure notice is given to the Health and Safety Executive (or Office of Rail Regulation)	5.00	4.15	1.238	83
20(1)(a)	Give suitable advice and assistance to the Client regarding compliance with the Clients' duties under the Regulations.	4.00	4.06	.954	81.2
20(1)(b)	Ensure that arrangements for coordination of health and safety measures during planning and preparation for the construction phase are implemented.	4.00	4.04	.898	80.8
20(2)(d)	Take all reasonable steps during the construction phase to ensure cooperation between designers and the Principal Contractor in relation to any design or design change.	4.00	3.90	.973	78
20(1)(c)	Liaise with the Principal Contractor regarding information required for the preparation of the Construction Phase Plan, contents of the Health and Safety File and any design development that may affect the planning and management of construction work.	4.00	3.81	1.065	76.2
20(2)(e)	Prepare where none exists the Health and Safety File and update/review for subsequent construction work.	3.00	2.83	1.326	56.6

An examination of the correlation between the stage of appointment and the extent of discharge of duties by the CDM-C (see also Table 7.9d) shows five statistically significant linear relationships significant at the 0.05 level:

- preparation and brief stage and ensuring that arrangements for coordination of health and safety measures are implemented (Regulation 20(1)(b)) (r = .303, p = .017, n = 47);
- preparation and brief stage and taking reasonable steps during the construction phase to ensure cooperation between the designer and the principal contractor in relation to any design or design change (Regulation 20(2)(d)) (r = .254, p = .045, n = 47);
- concept design stage and ensure notice is given to the HSE (Regulation 21) (r = -.281, p = .037, n = 47);
- concept design stage and liaising with the PC regarding information required for the preparation of the construction phase plan, contents of the H&S File and any design development (Regulation 20(1)(c)) (r = -.254, p = .046, n = 48); and
- construction stage and taking reasonable steps during the construction phase to ensure cooperation between the designer and the principal contractor (Regulation 20(2)(d)) (r = .302, p = .014, n = 47).

Table 7.9d: Correlation matrix: stage of appointment and discharge of duties (CDM-C)

Stage of appointment	Discharge of duty	20(1)(a)	20(1)(b)	20(2)(a)	20(2)(b)	21(1)	20(1)(c)	20(2)(c)	20(2)(d)	20(2)(e)	20(2)(f)
preparation and brief stage	Correlation Coefficient	.140	***.303****	.188	.085	-.122	.060	.200	***.254****	.083	.114
	Sig. (2-tailed)	.273	.017	.143	.506	.374	.646	.112	.045	.519	.384
	N	47	47	47	47	46	47	47	47	47	47
concept design stage	Correlation Coefficient	.067	.105	-.055	-.055	***-.281****	***-.254****	.027	-.073	-.188	-.163
	Sig. (2-tailed)	.590	.399	.664	.659	.037	.046	.829	.552	.136	.202
	N	48	48	48	48	47	48	48	48	48	48
developed design stage	Correlation Coefficient	-.188	.013	-.122	-.056	-.090	.045	-.114	-.007	-.007	.181
	Sig. (2-tailed)	.151	.921	.356	.668	.520	.733	.376	.956	.955	.173
	N	46	46	46	46	45	46	46	46	46	46
technical design stage	Correlation Coefficient	-.175	-.108	-.082	.015	.035	.104	-.138	-.093	.001	.153
	Sig. (2-tailed)	.163	.388	.516	.902	.798	.417	.265	.453	.992	.231
	N	47	47	47	47	46	47	47	47	47	47
construction stage	Correlation Coefficient	.055	.064	.055	.034	.239	.087	.065	***.302****	-.069	-.028
	Sig. (2-tailed)	.653	.607	.656	.786	.072	.489	.595	.014	.581	.827
	N	47	47	47	47	46	47	47	47	47	47

(*significant at the 0.05 level, green: positive correlation, red: negative correlation)

The observed relationships are surprising given that there are more associations with the early stages of appointment contrary to the earlier finding regarding the stage of appointment of the duty holder. Besides, it was expected that statistically significant relationships would emerge between the technical design stage or construction stage of appointment, and the discharge of various duties to corroborate the late stage of appointment. Having said that, this outcome statistically demonstrates that there is a link between the stage of appointment and extent of discharge of duties, although cautiously acknowledging that the relationship is not causal.

7.3.3 Implications of the stage of appointment (PC)

To examine the relationship between the appointment stage and the extent of discharge of PC duties, a correlation test is undertaken to determine the strength of any association (see Table 7.9e). The results show that there are six statistically significant relationships, two of which are negative. This means that an increase in the extent of discharge relates to a decrease in the likelihood of being appointed at that stage. These significant relationships are:

- preparation and brief stage and ensuring that site induction and training is provided to every worker (Regulation 22(2)) (r = -.270, p = .024, n = 62, significant at the 0.05 level);
- concept design stage and ensuring the construction phase is planned and monitored (Regulation 22(1)(a) (r = -.246, p = .036, n = 61, significant at the 0.05 level);
- construction stage and implementation of the construction phase plan (Regulation 23(1)(c)) (r = .313, p = .011, n = 62, significant at the 0.05 level);
- construction stage and displaying project notification information (Regulation 22(1)(k) (r = .293, p = .015, n = 62, significant at the 0.05 level);

- construction stage and preventing unauthorised persons access to the construction site (Regulation 22(1)(l) (r = .314, p = .009, n = 62, significant at the 0.01 level); and
- construction stage and ensuring site induction and training (Regulation 22(2)) (r = .268, p = .027, n = 62, significant at the 0.05 level) (see also Table 7.9e).

Using one of the above correlations to illustrate this further, Figure 7.1 shows the inverse relationship between the preparation and brief stage of appointment and the extent of discharge of ensuring site induction (Regulation 22(2)).

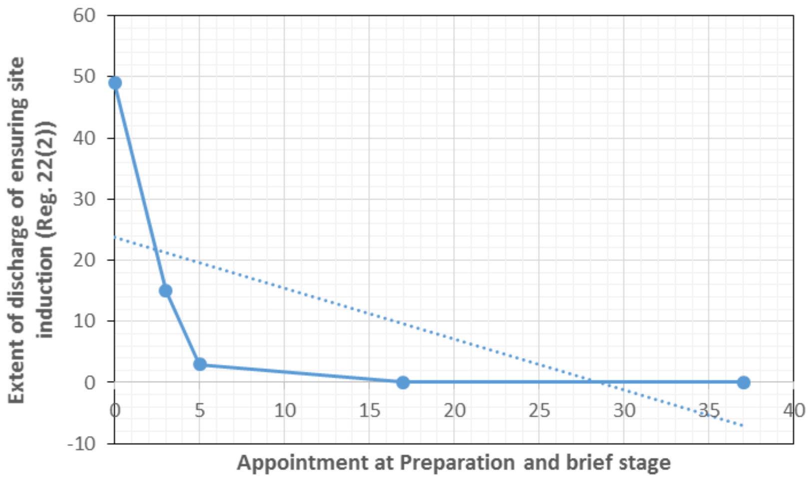

Figure 7.1: Negative correlation: appointment stage and extent of discharge of duty

The four positive linear relationships are all associated with the construction stage. Again, this outcome shows that there is a link between the appointment stage of the PC and the discharge of duties. However, there is need to further investigate the extent of discharge of individual duties.

Table 7.9e: Correlation matrix: stage of appointment and discharge of duties (PC)

Discharge of duty	preparation and brief stage – Correlation Coefficient	preparation and brief stage – Sig. (2-tailed)	preparation and brief stage – N	concept design stage – Correlation Coefficient	concept design stage – Sig. (2-tailed)	concept design stage – N	developed design stage – Correlation Coefficient	developed design stage – Sig. (2-tailed)	developed design stage – N
23(1)(a)	-.137	.240	62	-.006	.961	61	.069	.532	63
23(1)(c)	-.065	.595	62	-.163	.178	61	-.046	.685	63
23(1)(b)	.048	.676	62	.084	.458	61	.096	.369	63
23(2)	-.015	.895	62	-.030	.797	61	.008	.940	63
22(1)(a)	-.205	.082	62	**-.246***	.036	61	-.002	.989	63
22(1)(b)	-.086	.447	62	.020	.857	61	.066	.535	63
22(1)(c)	-.207	.086	62	-.149	.215	61	.007	.953	63
22(1)(d)	-.020	.867	62	-.028	.814	61	.051	.654	63
22(1)(e)	-.163	.168	62	-.073	.537	61	.011	.918	63
22(1)(f)	-.091	.419	62	-.024	.832	61	.021	.843	63
22(1)(g)	-.206	.066	62	-.193	.084	61	-.014	.896	62
22(1)(h)	-.002	.988	62	-.058	.605	61	.083	.428	63
22(1)(i)	-.100	.375	62	-.205	.068	61	-.007	.949	63
22(1)(j)	-.085	.457	62	-.094	.411	61	.039	.717	63
22(1)(k)	-.129	.274	62	-.167	.157	61	-.005	.962	63
22(1)(l)	-.186	.118	62	-.175	.144	61	.029	.798	63
22(2)	**-.270***	.024	62	-.125	.296	61	-.088	.434	63
24(a)	-.063	.590	62	.055	.641	61	.036	.745	63
24((b)	.047	.682	62	-.036	.749	61	.065	.539	63
24(c)	-.015	.890	62	-.077	.491	61	-.037	.727	63

technical design stage Correlation Coefficient	technical design stage Sig. (2-tailed)	technical design stage N	construction stage Correlation Coefficient	construction stage Sig. (2-tailed)	construction stage N
-.096	.382	63	.111	.351	62
-.040	.722	63	***.313****	.011	62
-.038	.722	63	.040	.731	62
-.134	.221	63	.069	.560	62
-.118	.285	63	.143	.230	62
.090	.396	63	-.008	.941	62
-.031	.780	63	.146	.231	62
.059	.603	63	.167	.171	62
-.049	.655	63	.135	.257	62
.031	.768	63	.004	.971	62
-.008	.939	63	.151	.181	62
.077	.466	63	.035	.760	62
-.022	.833	63	.178	.117	62
.126	.240	63	.185	.110	62
.001	.994	63	***.293****	.015	62
-.063	.573	63	***.314*****	.009	62
-.020	.859	63	***.268****	.027	62
-.005	.962	63	.122	.305	62
-.009	.929	63	.130	.257	62
.129	.219	63	.051	.649	62

(*significant at 0.05 level, **significant at the 0.01 level, green: positive correlation, red: negative correlation)

7.4. EXTENT OF DISCHARGE OF DUTIES BY RESPONDENTS APPOINTED IN THE ROLE OF CDM-C AND PC: FINDINGS AND DISCUSSION

On a number of occasions, the role of CDM-C has been perceived as having little value in managing H&S on construction sites (e.g. SEC, 2010). The duties of the CDM-C are very often regarded as misunderstood or even misinterpreted (e.g. Dalby, 2009). The role of the PC on the other hand has received minimal criticism, although controversies surrounding the title of 'Principal Contractor' in relation to duties that have traditionally always been undertaken by the contractor have been highlighted by Mzyece *et al.* (2012a). In order to achieve the aim of this chapter, respondents were requested to rate the extent of discharge of duties in practice. Findings are discussed in the next two subsections.

7.4.1 Extent of discharge of duties (CDM-C)

CDM-Cs were asked to rate the extent to which they discharged their duties based on a 5-point likert scale (i.e. 5 - '*always*', 4 - '*often*', 3 - '*sometimes*', 2 - '*rarely*' and 1 - '*never*'), and the results show discrepancies. The disparities in the discharge of duties are evident from results shown in Tables 7.10 and 7.11; ranked in descending order according to the relative index analysis score. It is observed that, significantly, some duties are not always discharged as required by the law raising doubt as to whether the law is adhered to completely. Indeed, this also questions the enforcement of the law as well as liability issues. Undoubtedly, these inconsistencies between practice and the legal requirement may come about because of various reasons such as the appointment stage of the duty holder or the influence of project features such as the type, complexity, procurement route, and degree of involvement of other project stakeholders (e.g. Evans, 2008; Scopes, 2009b; Webster, 2013).

These findings further reveal differences pertaining to the extent of discharge of each duty, demonstrated by the standard deviation, particularly where it is more than 1.0. For example, the duty to prepare the H&S File (Regulation 20(2)(e)) and its subsequent handover to the Client (Regulation 20(2)(f)) are discharged differently by the CDM-Cs. Further, it is observed that there are variances regarding the extent of discharge of duties. For example, ensuring notice is given to the HSE (Regulation 21(1)) yields a median score of 5.00 and a mean score of 4.83, while ensuring arrangements for coordination (Regulation 20(1)(b)) scores were, 3.50 (median) and 3.54 (mean).

This observation is surprising given the importance of project coordination arrangements which is central to the role of the CDM-C (e.g. Barnard, 2007; Scopes, 2009b; ICE, 2011; Frontline Consultants, 2012b). Other duties involving engaging with project stakeholders such as facilitating cooperation between the Designer and PC (Regulation 20(2)(d)) and ensuring that Designers comply with their duties (Regulation 20(2)(c)) were ranked eighth and ninth. However, this may ultimately be of no surprise given the late appointment of the duty holders fulfilling the CDM-C and PC roles, which reduces opportunities for team development and collaboration. Indeed, it may well also be that other duty holders are resentful of the CDM-C role; perceiving it as another ‘stumbling block’ or just being there to make their jobs much more difficult and bureaucratic. This perception may have bred mistrust and an unwillingness to cooperate with this duty holder. This proposition is not beyond the realms of possibility, but with no specific theoretical evidence underpinning this claim, further research is required. However, earlier results relating to the appointment stage corroborate this argument.

Table 7.10: Extent of discharge of CDM-C duties (central tendency scores)

Reg.	Description of duties	Median	Mean	Std. Dev.	Std. Error	Rank
21(1)	Ensure notice is given to the Health and Safety Executive (or Office of Rail Regulation)	5.00	4.83	0.433	0.063	1
20(1)(c)	Liaise with the Principal Contractor regarding information required for the preparation of the Construction Phase Plan, contents of the Health and Safety File and any design development that may affect the planning and management of construction work	5.00	4.29	0.824	0.119	2
20(2)(f)	Handover the Health and Safety File to the Client at the end of the construction phase	4.00	4.23	1.016	0.147	3
20(2)(a)	Take reasonable steps towards identifying and collecting preconstruction information	4.00	4.10	0.881	0.127	4
20(2)(e)	Prepare where none exists the Health and Safety File and update/review for subsequent construction work	4.00	4.10	1.115	0.161	5
20(1)(a)	Give suitable advice and assistance to the Client regarding compliance with the Clients' duties under the Regulations	4.00	4.04	0.967	0.140	6
20(2)(b)	Promptly provide preconstruction information to all Designers, Contractors and the Principal Contractor.	4.00	4.04	0.988	0.143	7
20(2)(d)	Take all reasonable steps during the construction phase to ensure cooperation between Designers and the Principal Contractor in relation to any design or design change	4.00	3.67	0.996	0.144	8
20(2)(c)	Take reasonable steps to ensure Designers comply with their duties and provide sufficient information about aspects of the design to assist other Designers, Clients, the CDM Coordinator and Contractors	4.00	3.67	0.996	0.144	9
20(1)(b)	Ensure that arrangements for coordination of health and safety measures during planning and preparation for the construction phase are implemented	3.50	3.54	0.898	0.130	10

7.4.2 Extent of discharge of duties (PC)

The main contractor, sometimes referred to as a tier 1 contractor, is normally appointed in the role of PC (e.g. Shiplee *et al.*, 2011; Webster, 2013). This is consistent with the suggestion under the ACoP (see paragraph 147). PCs sampled were asked to rate the extent of discharge of duties. Table 7.12 provides a detailed summary regarding the extent of discharge of duties of the PC. An examination of the central tendency scores and relative indices (RI) reveal interesting insights regarding the discharge of these duties (see Table 7.13). Arranged in descending order according to the RI, the results reveal significant differences in the discharge of duties. A high score of the RI means that it is discharged more frequently.

Tables 7.12 and 7.13 show that drawing up site rules towards the H&S of construction site activities (Regulation 22(1)(d)) is the most frequently discharged duty, followed by ensuring adequate provision of welfare facilities (Regulation 22(1)(c)). Ensuring that workers or their representatives can inspect and take copies of any planning and management information relating to the project (Regulation 24(c)) is the least frequently discharged duty, ranked 20. Similar to the CDM-C duties, it appears the least discharged duties as shown in Table 7.14 (e.g. 24(c), 22(1)(g), 22(1)(f), 22(1)(i), 22(1)(b), etc.) all seem to relate to cooperation and collaboration with other duty holders and workers. This signals a failure to realise the TMCS objective of cooperation and collaboration in H&S management and provides supportive evidence for reform of the CDM 2007.

Further, a pattern worth noting relates to the sequence of the discharge of duties in relation to the Construction Phase Plan (CPP). It is surprising that implementation of the CPP (Regulation 23(1)(c)) is discharged more frequently than its actual preparation (Regulation 23(1)(a)). In other words, its preparation, should commensurate its implementation. Understandably though, updating of the CPP (Regulation 23(1)(b)) is discharged less frequently than its implementation (Regulation 23(1)(c)), which is understandable given that this is subject to project particulars and needs. However, ensuring contractors have access to relevant parts of the CPP (Regulation 22(1)(h)) was the least frequently discharged among the four duties, which perhaps indicates an existence of collaboration challenges.

With the exception of the duty of ensuring workers or their representatives can inspect information relating to planning and management of the project (Regulation 24(c)) with a mean score of 3.34, which only indicates that it is discharged sometimes, the majority of the duties are frequently discharged. Even though this still falls short of the regulatory requirement for duties to be discharged always, they are still discharged more frequently than the CDM-C duties, which may suggest that the PC is more conversant with their duties than the CDM-C or finds them less difficult. To examine the extent to which respondents found discharging the duties as difficult, responses based on a 5-point likert scale (i.e. 5 – '*most burdensome*', 4 – '*burdensome*', 3 – '*even*', 2 – '*somehow burdensome*', 1 – '*least burdensome*') were obtained from research participants for all the CDM-C and PC duties. Findings are discussed in Section 7.5.

Table 7.11: Extent of discharge of CDM-C duties (frequency distribution)

Reg.	1-never, *n* (%)	2-rarely, *n* (%)	Cumulative (1+2), *n* (%)	3-sometimes, *n* (%)	4-often, *n* (%)	5-always, *n* (%)	Cumulative (4+5), *n* (%)	R.I.
21(1)	0 (0)	0 (0)	0 (0)	1 (2.1)	6 (12.5)	40 (83.3)	46 (95.8)	96.6
20(1)(c)	0 (0)	0 (0)	0 (0)	11 (22.9)	12 (25)	25 (52.1)	37 (77.1)	85.8
20(2)(f)	2 (4.15)	2 (4.15)	4 (8.3)	2 (4.2)	19 (39.6)	23 (47.9)	42 (87.5)	84
20(2)(a)	0 (0)	3 (6.2)	3 (6.2)	7 (14.6)	20 (41.7)	18 (37.5)	38 (79.2)	82
20(2)(e)	3 (6.2)	2 (4.2)	5 (10.4)	3 (6.2)	19 (39.6)	21 (43.8)	40 (83.4)	82
20(1)(a)	0 (0)	3 (6.2)	3 (6.2)	12 (25)	13 (27.1)	20 (41.7)	33 (68.8)	80.8
20(2)(b)	1 (2.1)	3 (6.2)	4 (8.3)	7 (14.6)	19 (39.6)	18 (37.5)	37 (77.1)	80.8
20(2)(d)	0 (0)	8 (16.7)	8 (16.7)	10 (20.8)	20 (41.7)	10 (20.8)	30 (62.5)	73.4
20(2)(c)	0 (0)	7 (14.6)	7 (14.6)	13 (27.1)	17 (35.4)	11 (22.9)	28(58.3)	73.4
20(1)(b)	1 (2.1)	3 (6.2)	4 (8.3)	20 (41.7)	17 (35.4)	7 (14.6)	24 (50)	70.8

Table 7.12: Extent of discharge of PC duties (central tendency scores)

Reg.	Description of duties	Median	Mean	Std. Dev.	Std. Error	Rank
22(1)(d)	Draw up site rules where necessary for health and safety, appropriate to the construction site/activities.	5.00	4.76	0.495	0.060	1
22(1)(c)	Ensure provision of adequate welfare facilities throughout the construction phase.	5.00	4.75	0.503	0.061	2
23(1)(c)	Implement the construction phase plan to ensure the health and safety of all persons carrying out the construction work.	5.00	4.73	0.539	0.066	3
22(2)	Ensure provision of site induction and training to every worker carrying out the construction work.	5.00	4.69	0.556	0.068	4
22(1)(k)	Ensure project notification particulars displayed in a legible manner, read by any worker engaged in the construction work.	5.00	4.58	0.819	0.100	5
22(1)(l)	Take reasonable steps to prevent persons unauthorised to access the construction site.	5.00	4.55	0.724	0.088	6
23(1)(a)	Prepare the construction phase plan before construction work and pay adequate attention to information provided by the designer.	5.00	4.48	0.927	0.113	7
22(1)(a)	Ensure that the construction phase is planned, managed, and monitored in a reasonably practicable manner, while facilitating cooperation and coordination between contractors and pursuance of the general principles of prevention.	5.00	4.42	0.678	0.083	8
22(1)(e)	Offer reasonable directions to any contractor when necessary to enable compliance with his duties under the Regulations.	5.00	4.40	0.676	0.083	9
23(2)	Take all reasonable steps to ensure that the construction phase plan identifies the risks to health and safety.	5.00	4.40	0.719	0.088	10
24(a)	Facilitate cooperation with workers engaged in the construction work and developing measures to ensure health, safety, or welfare of workers and checking the effectiveness of such measures.	4.00	4.18	0.757	0.093	11
23(1)(b)	Update, review, and revise the construction phase plan when appropriate throughout the project.	4.00	4.00	0.921	0.113	12
22(1)(j)	Ensure each contractor promptly provides construction activity information likely to be required by the CDM Coordinator for inclusion in the Health and Safety File	4.00	3.94	0.851	0.104	13
22(1)(h)	Ensure all contractors have access to the relevant part of the construction phase plan before actual construction work	4.00	3.88	1.038	0.127	14
24(b)	Consult workers or their representatives on matters regarding the project in line with their health, safety, and welfare.	4.00	3.84	0.963	0.118	15
22(1)(b)	Liaise with the CDM Coordinator and Designers regarding any design/or change to design during the construction phase.	4.00	3.69	0.925	0.113	16
22(1)(i)	Ensure contractors are given sufficient time before construction work to prepare and provide welfare facilities and carry out work without risk.	4.00	3.69	1.062	0.130	17
22(1)(f)	Ensure contractors are informed of the minimum amount of time required for preconstruction planning before actual construction work.	4.00	3.66	0.946	0.116	18
22(1)(g)	Consult contractors where necessary before finalising the part of the	4.00	3.55	1.010	0.124	19

Reg.	Description of duties	Median	Mean	Std. Dev.	Std. Error	Rank
	construction phase plan relevant to his work.					
24(c)	Ensure that workers or their representatives can inspect and take copies of any planning and management information, which relates to the project.	3.00	3.34	1.052	0.129	20

(See box plots – Appendix 7)

Table 7.13: Extent of discharge of PC duties (frequency distribution)

Reg.	1-never, *n* (%)	2-rarely, *n* (%)	Cumulative (1+2), *n* (%)	3-sometimes, *n* (%)	4-often, *n* (%)	5-always, *n* (%)	Cumulative (4+5), *n* (%)	R.I.
22(1)(d)	0 (0)	0 (0)	0 (0)	2 (3)	12 (17.9)	53 (79.1)	65 (97)	95.2
22(1)(c)	0 (0)	0 (0)	0 (0)	2 (3)	13 (19.4)	52 (77.6)	65 (97)	95
23(1)(c)	0 (0)	1 (1.5)	1 (1.5)	0 (0)	15 (22.4)	51 (76.1)	66 (98.5)	94.6
22(2)	0 (0)	0 (0)	0 (0)	3 (4.5)	15 (22.4)	49 (73.1)	64 (95.5)	93.8
22(1)(k)	1 (1.5)	1 (1.5)	2 (3)	5 (7.5)	11 (16.4)	49 (73.1)	60 (89.5)	91.6
22(1)(l)	1 (1.5)	0 (0)	1 (1.5)	3 (4.5)	20 (29.9)	43 (64.2)	63 (94.1)	91
23(1)(a)	2 (3)	1 (1.5)	3 (4.5)	5 (7.5)	14 (20.9)	45 (67.2)	59 (88.1)	89.6
22(1)(a)	0 (0)	0 (0)	0 (0)	7 (10.4)	25 (37.3)	35 (52.2)	60 (89.5)	88.4
22(1)(e)	0 (0)	0 (0)	0 (0)	7 (10.4)	26 (38.8)	34 (50.7)	60 (89.5)	88
23(2)	0 (0)	0 (0)	0 (0)	9 (13.4)	22 (32.8)	36 (53.7)	58 (86.5)	88
24(a)	0 (0)	2 (3)	2 (3)	8 (11.9)	33 (49.3)	24 (35.8)	57 (85.1)	83.6
23(1)(b)	1 (1.5)	2 (3)	3 (4.5)	16 (23.9)	25 (37.3)	23 (34.3)	48 (71.6)	80
22(1)(j)	0 (0)	2 (3)	2 (3)	20 (299)	25 (37.3)	20 (29.9)	45 (67.2)	78.8
22(1)(h)	1 (1.5)	6 (9)	7 (10.5)	16 (23.9)	21 (31.3)	23 (34.3)	44 (65.6)	77.6
24(b)	0 (0)	6 (9)	6 (9)	19 (28.4)	22 (32.8)	20 (29.9)	42 (62.7)	76.8
22(1)(b)	2 (3)	4 (6)	6 (9)	18 (26.9)	32 (47.8)	11 (16.4)	43 (64.2)	73.8
22(1)(i)	1 (1.5)	7 (10.4)	8 (11.9)	24 (35.8)	15 (22.4)	20 (29.9)	35 (52.3)	73.8
22(1)(f)	0 (0)	8 (11.9)	8 (11.9)	21 (31.3)	24 (35.8)	14 (20.9)	38 (56.7)	73.2
22(1)(g)	0 (0)	12 (17.9)	12 (17.9)	19 (28.4)	22 (32.8)	13 (19.4)	35 (52.2)	71
24(c)	3 (4.5)	11 (16.4)	14 (20.9)	22 (32.8)	22 (32.8)	9 (13.4)	31 (46.2)	66.8

7.5 THE PERCEIVED DEGREE OF DIFFICULTY OF DUTIES PERFORMED BY THE CDM-C AND PC: FINDINGS AND DISCUSSION

The implementation of the CDM Regulations is often reported as administratively burdensome (e.g. Bomel Ltd, 2007), sometimes as a result of industry commercial pressure (e.g. Frontline Consultants, 2012a). Excessive paperwork is often reported as an undesirable consequence in practice (e.g SEC, 2010). However, the extent to which specific duties are perceived as a burden or indeed difficult to discharge is unclear even though it is widely acknowledged and commonplace for CDM duties to be perceived as a burden (e.g. Bomel Ltd, 2007). To bridge this gap in knowledge, respondents were queried on this matter.

7.5.1 Perceived degree of difficulty: duties of the CDM-C

Table 7.14 ranks duties of the CDM-C according to the perceived degree of difficulty of the duties by virtue of the administrative work, organisational effort, and paperwork generated. The duties are ranked in descending order from most difficult to least difficult. It is clear that the respondents' views concerning the difficulty of duties vary, not only across the duties, but also among the CDM-Cs. Some CDM-Cs found particular duties more difficult to discharge whilst other CDM-Cs found those same duties less difficult. For example, the highest rating considering the duty to handover the H&S File (Regulation 20(2)(f)) is 5 (most burdensome), whilst the lowest was 1 (least burdensome). This pattern is repeated for most duties.

By comparing the perceived degree of difficulty of duties, it was found that some duties were considered far more difficult to discharge than other duties. For example ensuring notice is given to the relevant authority (Regulation 21(1)) had the lowest relative index analysis value (RI = 29.4) compared with liaising with the Designers to ensure that they comply with their obligations (Regulation 20(2)(c)) (RI = 71). An examination of Table 7.14 shows that the following three are relatively the most difficult duties to discharge:

(i) ensuring Designers comply with their duties (Regulation 20(2)(c));

(ii) preparing the H&S File (Regulation 20(2)(e)); and

(iii) liaising with the PC regarding preparation of the Construction Phase Plan (Regulation 20(1)(c)).

It is also interesting to observe that all the highest ranked duties involve an element of cooperation and collaboration with other duty holders, which signals failure of CDM-Cs to collaborate with other duty holders in terms of interdependent working.

Table 7.14: Perceived degree of difficulty of CDM-C duties

Description of duties (CDM Coordinator)	Reg.	Median	Mean	Std. Dev.	Std. Error	R.I.	Rank
Take reasonable steps to ensure Designers comply with their duties and provide sufficient information about aspects of the design to assist other Designers, Clients, the CDM Coordinator and Contractors	20(2)(c)	4.00	3.55	1.212	0.177	71.0	1
Prepare where none exists the Health and Safety File and update/review for subsequent construction work.	20(2)(e)	4.00	3.46	1.206	0.178	69.2	2
Liaise with the Principal Contractor regarding information required for the preparation of the Construction Phase Plan, contents of the Health and Safety File and any design development that may affect the planning and management of construction work.	20(1)(c)	3.00	3.15	1.142	0.167	63.0	3
Take all reasonable steps during the construction phase to ensure cooperation between Designers and the Principal Contractor in relation to any design or design change.	20(2)(d)	3.00	3.09	1.176	0.172	61.8	4
Take reasonable steps towards identifying and collecting preconstruction information	20(2)(a)	3.00	2.66	0.984	0.144	53.2	5
Handover the Health and Safety File to the Client at the end of the construction phase	20(2)(f)	3.00	2.57	1.344	0.198	51.4	6
Promptly provide preconstruction information to all Designers, Contractors and the Principal Contractor.	20(2)(b)	3.00	2.53	0.952	0.139	50.6	7
Ensure that arrangements for coordination of health and safety measures during planning and preparation for the construction phase are implemented	20(1)(b)	3.00	2.51	0.997	0.145	62.7	8
Give suitable advice and assistance to the Client regarding compliance with the Clients' duties under the Regulations.	20(1)(a)	2.00	2.17	1.049	0.153	43.4	9
Ensure notice is given to the Health and Safety Executive (or Office of Rail Regulation)	21(1)	1.00	1.47	0.776	0.113	29.4	10

7.5.2 Perceived degree of difficulty: duties of the PC

To investigate the perceived degree of difficulty of PC duties, similar responses to that of the CDM-C were obtained and summarised in Table 7.15. Ranking the duties according to the central tendency values shows that the top three duties perceived most difficult are:

(i) ensuring contractors promptly provide preconstruction information required by the CDM-C for the subsequent preparation of the H&S File (Regulation 22(1)(j));

(ii) liaising with the Designer and the CDM-C (Regulation 22(1)(b)); and

(iii) consulting contractors (Regulation 22(1)(g)).

Table 7.15: Perceived degree of difficulty of PC duties

Description of duties (Principal Contractor)	Reg.	Median	Mean	Std. Dev.	Std Error	R.I	Rank
Ensure each contractor promptly provides construction activity information likely to be required by the CDM Coordinator for inclusion in the Health and Safety File	22(1)(j)	4.00	3.39	1.239	0.152	67.8	1
Liaise with the CDM Coordinator and Designers regarding any design/or change to design during the construction phase.	22(1)(b)	3.00	3.02	1.097	0.136	60.4	2
Consult contractors where necessary before finalising the part of the construction phase plan relevant to his work.	22(1)(g)	3.00	2.98	1.015	0.125	59.6	3
Prepare the construction phase plan before construction work and pay adequate attention to information provided by the designer.	23(1)(a)	2.50	2.68	1.152	0.142	53.6	4
Update, review, and revise the construction phase plan when appropriate throughout the project.	23(1)(b)	3.00	2.64	1.047	0.129	52.8	5
Ensure that the construction phase is planned, managed, and monitored in a reasonably practicable manner, while facilitating cooperation and coordination between contractors and pursuance of the general principles of prevention.	22(1)(a)	2.50	2.61	1.122	0.138	52.2	6
Ensure contractors are given sufficient time before construction work to prepare and provide welfare facilities and carry out work without risk.	22(1)(i)	3.00	2.58	1.138	0.140	51.6	7
Ensure that contractors are informed of the minimum amount of time required for preconstruction planning before actual construction work.	22(1)(f)	3.00	2.55	0.845	0.104	51.0	8
Consult workers or their representatives on matters regarding the project in line with their health, safety, and welfare.	24(b)	2.50	2.53	1.070	0.132	50.6	9
Ensure that workers or their representatives can inspect and take copies of any planning and management information, which relates to the project.	24(c)	2.00	2.49	1.106	0.137	49.8	10
Ensure all contractors have access to the relevant part of the construction phase plan before actual construction work.	22(1)(h)	2.00	2.47	1.112	0.137	49.4	11
Facilitate cooperation with workers engaged in the construction work and developing measures to ensure health, safety, or welfare of workers and checking the effectiveness of such measures.	24(a)	2.00	2.44	1.111	0.137	48.8	12
Take all reasonable steps to ensure that the construction phase plan identifies the risks to health and safety.	23(2)	2.00	2.42	1.053	0.130	48.4	13
Implement the construction phase plan to ensure the health and safety of all persons carrying out the construction work.	23(1)(c)	2.00	2.39	1.080	0.133	47.8	14
Ensure site induction and training is provided to every worker carrying out the construction work.	22(2)	2.00	2.36	1.198	0.147	47.2	15
Offer reasonable directions to any contractor when necessary to enable compliance with his duties under the Regulations.	22(1)(e)	2.00	2.12	1.008	0.125	42.4	16
Take reasonable steps to prevent persons unauthorised to access the construction site.	22(1)(l)	2.00	1.91	0.890	0.110	38.2	17
Ensure provision of adequate welfare facilities throughout the construction phase.	22(1)(c)	2.00	1.88	0.985	0.121	37.6	18
Ensure project notification particulars displayed in a legible manner to be read by any worker engaged in the construction work.	22(1)(k)	2.00	1.74	0.882	0.109	34.8	19
Draw up site rules where necessary for health and safety, appropriate to the construction site/activities.	22(1)(d)	1.00	1.68	0.856	0.102	33.6	20

Although it is clear that the PC has more duties to execute relative to the CDM-C, fewer of the PC duties are perceived to be difficult. Even though these results are not directly comparable, it does raise the question of whether PCs are better equipped to attend to H&S matters on projects than CDM-Cs who tend to find similar duties more challenging. There is no doubt that the effort and persistence required to discharge the duties differs. Further investigation is therefore required, to identify duties that would invite amending.

7.6 THE PERCEIVED DEGREE OF IMPORTANCE OF DUTIES IN TERMS POSITIVE HEALTH AND SAFETY IMPACT: FINDINGS AND DISCUSSION

Having examined the extent of discharge of duties and the perceived degree of difficulty to discharge duties in practice, this section explores their perceived degree of importance. A five-point likert scale was employed as follows: 5 – '*most important*', 4 – '*important*', 3 – '*even*', 2 – '*less important*' and 1 – '*least important*'. Similar to the analysis in the previous section, a careful inspection of the central tendency scores is undertaken, as discussed below.

7.6.1 Perceived degree of importance: duties of the CDM-C

Table 7.16 reveals that provision of preconstruction information Regulation 20(2)(b)) is perceived as the most important duty by CDM-Cs (i.e. ranked as 1). Taking reasonable steps towards identifying and collecting preconstruction information (Regulation 20(2)(a)) was ranked second, while ensuring arrangements for coordination of H&S measures during planning and preparation of the construction phase was ranked as the third most important duty. Even though the ranking of duties shows some disparity regarding their perceived degree of importance, the relative index analysis values appear to suggest that all the duties were largely considered important.

Table 7.16: Perceived degree of importance of CDM-C duties

Description of duties	Reg.	Median	Mean	Std. Dev.	Std. Error	R.I.	Rank
Promptly provide preconstruction information to all Designers, Contractors and the Principal Contractor.	20(2)(b)	4.00	4.37	.606	.087	87.6	1
Take reasonable steps towards identifying and collecting preconstruction information	20(2)(a)	4.00	4.31	0.829	0.120	86.2	2
Ensure that arrangements for coordination of health and safety measures during planning and preparation for the construction phase are implemented	20(1)(b)	5.00	4.29	0.922	0.133	85.8	3
Liaise with the Principal Contractor regarding information required for the preparation of the Construction Phase Plan, contents of the Health and Safety File and any design development that may affect the planning and management of construction work.	20(1)(c)	4.00	4.23	0.758	0.111	84.6	4
Give suitable advice and assistance to the Client regarding compliance with the Clients' duties under the Regulations.	20(1)(a)	4.00	4.06	1.099	0.159	81.2	5
Take reasonable steps to ensure Designers comply	20(2)(c)	4.00	4.04	0.849	0.123	80.8	6

Description of duties	Reg.	Median	Mean	Std. Dev.	Std. Error	R.I.	Rank
with their duties and provide sufficient information about aspects of the design to assist other Designers, clients, the CDM Coordinator and Contractors							
Prepare where none exists the Health and Safety File and update/review for subsequent construction work.	20(2)(e)	4.00	3.83	1.078	0.156	76.6	7
Handover the Health and Safety File to the Client at the end of the construction phase	20(2)(f)	4.00	3.83	1.209	0.174	76.6	8
Take all reasonable steps during the construction phase to ensure cooperation between Designers and the Principal Contractor in relation to any design or design change.	20(2)(d)	4.00	3.81	0.816	0.118	76.2	9
Ensure notice is given to the Health and Safety Executive (or Office of Rail Regulation)	21(1)	4.00	3.81	1.424	0.206	76.2	10

The three duties of the CDM-C that were perceived least important are: (i) ensuring notice is given to the relevant authority (Regulation 21(1)); (ii) taking reasonable steps by ensuring cooperation between the Designer and PC; and (iii) handing over the H&S File to the Client (Regulation 20(2)(f)). Again, the emerging trend here shows cooperation and collaboration difficulties between the CDM-Cs and the other duty holders.

7.6.2 Perceived degree of importance: duties of the PC

The results pertaining to the perceived degree of importance of the PC's duties show a similar trend with the empirical evidence provided in relation to CDM-C duties. It is clear that the PCs perceive the majority of their duties as important (see Table 7.17). However, despite most duties being perceived as important, disparities still emerge in terms of the degree of importance. The three duties of the PC perceived most important are:

- ensuring site induction and training (Regulation 22(2));
- implementing the construction phase plan (Regulation 23(1)(c)); and
- ensuring the construction phase is planned and monitored (Regulation 22(1)(a)).

The duties that were perceived least important are:

- ensuring workers or their representatives can inspect planning and management information (Regulation 24(c));

- ensuring project notification particulars are properly displayed (Regulation 22(1)(k));
- liaising with the CDM-C and the Designer regarding changes to design (Regulation 22(1)(b)).

Surprisingly, despite perceiving site induction and training of workers as most important, enabling workers to have access to planning and management information was perceived unimportant. The underlying reason for such a contradiction requires further investigation, yet could well be a manifestation of the tensions that characterise management, staff, and union relationships in industries like construction. As such, further tests are required to determine the existence of relationships between the perceived degree of importance and difficulty (independent variables), and subsequently the impacts on the extent of discharge of such duties (dependent variable).

Table 7.17: Perceived degree of importance of PC duties

Description of duties	Reg.	Median	Mean	Std. Dev.	Std. Error	R.I.	Rank
Ensure site induction and training is provided to every worker carrying out the construction work.	22(2)	5.00	4.67	0.613	0.075	93.4	1
Implement the construction phase plan to ensure the health and safety of all persons carrying out the construction work.	23(1)(c)	5.00	4.66	0.729	0.089	93.2	2
Ensure that the construction phase is planned, managed, and monitored in a reasonably practicable manner, while facilitating cooperation and coordination between contractors and pursuance of the general principles of prevention.	22(1)(a)	5.00	4.58	0.781	0.095	91.6	3
Ensure provision of adequate welfare facilities throughout the construction phase.	22(1)(c)	5.00	4.55	0.784	0.096	91.0	4
Take all reasonable steps to ensure that the construction phase plan identifies the risks to health and safety.	23(2)	5.00	4.47	0.932	0.115	89.4	5
Take reasonable steps to prevent persons unauthorised to access the construction site.	22(1)(l)	5.00	4.45	0.764	0.093	89.0	6
Prepare the construction phase plan before construction work and pay adequate attention to information provided by the designer.	23(1)(a)	5.00	4.45	0.892	0.109	89.0	7
Draw up site rules where necessary for health and safety, appropriate to the construction site/activities.	22(1)(d)	5.00	4.42	0.878	0.108	88.4	8
Facilitate cooperation with workers engaged in the construction work and developing measures to ensure health, safety, or welfare of workers and checking the effectiveness of such measures.	24(a)	4.00	4.25	0.876	0.107	85.0	9
Offer reasonable directions to any contractor when necessary to enable compliance with his duties under the Regulations.	22(1)(e)	4.00	4.19	0.821	0.100	83.8	10
Consult workers or their representatives on matters regarding the project in line with their health, safety, and welfare.	24(b)	4.00	4.12	0.962	0.117	82.4	11
Ensure contractors are given sufficient time before construction work to prepare and provide welfare facilities and carry out work without risk.	22(1)(i)	4.00	4.02	1.015	0.125	80.4	12
Ensure each contractor promptly provides construction activity	22(1)(j)	4.00	4.01	0.913	0.112	80.2	13

Description of duties	Reg.	Median	Mean	Std. Dev.	Std. Error	R.I.	Rank
information likely to be required by the CDM Coordinator for inclusion in the Health and Safety File.							
Update, review, and revise the construction phase plan when appropriate throughout the project.	23(1)(b)	4.00	4.00	1.015	0.124	80.0	14
Ensure all contractors have access to the relevant part of the construction phase plan before actual construction work.	22(1)(h)	4.00	3.97	0.984	0.120	79.4	15
Ensure that contractors are informed of the minimum amount of time required for preconstruction planning before actual construction work.	22(1)(f)	4.00	3.87	0.851	0.104	77.4	16
Consult contractors where necessary before finalising the part of the construction phase plan relevant to his work.	22(1)(g)	4.00	3.85	0.839	0.103	77.0	17
Liaise with the CDM Coordinator and Designers regarding any design/or change to design during the construction phase.	22(1)(b)	4.00	3.79	0.978	0.119	75.8	18
Ensure project notification particulars are displayed in a legible manner to be read by any worker engaged in the construction work.	22(1)(k)	4.00	3.71	1.274.	0.157	74.2	19
Ensure that workers or their representatives can inspect and take copies of any planning and management information, which relates to the project.	24(c)	3.00	3.51	1.120	0.137	70.2	20

7.7 COMPARISON BETWEEN THE EXTENT OF DISCHARGE OF DUTIES AND THE PERCEIVED DEGREE OF IMPORTANCE AND DIFFICULTY: FINDINGS AND DISCUSSION

Before considering the emerging correlations, the weighted mean scores of the three parameters are analysed across the three variables. The results indicate that the all the duties placed on CDM-Cs and PCs are typically discharged on a frequent basis and perceived important. Despite this positive outlook, 20% of the duties of the CDM-C were typically perceived difficult (i.e. 2 of 10), whereas none of the duties of the PC were typically considered difficult to discharge. This inference was reached by rating the mean score of a duty as greater than or equal to ‘3.5’, implying that a duty is discharged frequently. On the other hand, a mean score of less than or equal ‘2.5’ suggests the opposite. Similarly, the mean score of the importance parameter adopts the same explanation, while the mean score of the difficulty parameter has a different interpretation. A mean score greater than or equal to ‘3.5’ suggests that the duty is discharged with some degree of difficulty, while a mean score less than or equal to ‘2.5’ implies that the duty is easier or less difficult to discharge. A summary of these ratings is shown in Tables 7.18 and 7.19.

Table 7.18: Comparison of weighted mean scores: duties of the CDM-C (cross-tabulation)

	Variables	Discharge			Burdensome			Importance		
Description of duties (CDM Coordinator)	**Mean / Reg.**	**≥ 3.5**	**≤ 2.5**	**Rank**	**≥ 3.5**	**≤ 2.5**	**Rank**	**≥ 3.5**	**≤ 2.5**	**Rank**
Give suitable advice and assistance to the Client regarding compliance with the Clients' duties under the Regulations.	20(1)(a)	✓		6		✓	9	✓		5
Ensure that arrangements for coordination of health and safety measures during planning and preparation for the construction phase are implemented	20(1)(b)	✓		10		✓	8	✓		3
Liaise with the Principal Contractor regarding information required for the preparation of the Construction Phase Plan, contents of the Health and Safety File and any design development that may affect the planning and management of construction work.	20(1)(c)	✓		2			3	✓		4
Take reasonable steps towards identifying and collecting preconstruction information	20(2)(a)	✓		4			5	✓		2
Promptly provide preconstruction information to all Designers, Contractors and the Principal Contractor.	20(2)(b)	✓		7		✓	7	✓		1
Take reasonable steps to ensure Designers comply with their duties and provide sufficient information about aspects of the design to assist other designers, clients, the CDM Coordinator and Contractors	20(2)(c)	✓		9	✓		1	✓		6
Take all reasonable steps during the construction phase to ensure cooperation between Designers and the Principal Contractor in relation to any design or design change.	20(2)(d)	✓		8			4	✓		9
Prepare where none exists the Health and Safety File and update/review for subsequent construction work.	20(2)(e)	✓		5	✓		2	✓		7
Handover the Health and Safety File to the Client at the end of the construction phase	20(2)(f)	✓		3			6	✓		8
Ensure notice is given to the Health and Safety Executive (or Office of Rail Regulation)	21(1)	✓		1		✓	10	✓		10

Table 7.19: Comparison of weighted mean scores: duties of the PC (cross-tabulation)

	Variables	Discharge			Burdensome			Importance		
Description of duties (Principal Contractor)	**Mean / Reg.**	**≥ 3.5**	**≤ 2.5**	**Rank**	**≥ 3.5**	**≤ 2.5**	**Rank**	**≥ 3.5**	**≤ 2.5**	**Rank**
Ensure that the construction phase is planned, managed, and monitored in a reasonably practicable manner, while facilitating cooperation and coordination between contractors and pursuance of the general principles of prevention.	22(1)(a)	✓		8			6	✓		3
Liaise with the CDM Coordinator and Designers regarding any design/or change to design during the construction phase.	22(1)(b)	✓		16			2	✓		18
Ensure provision of adequate welfare facilities throughout the construction phase.	22(1)©	✓		2		✓	18	✓		4
Draw up site rules where necessary for health and safety, appropriate to the construction site/activities.	22(1)(d)	✓		1		✓	20	✓		8
Offer reasonable directions to any contractor when necessary to enable compliance with his duties under the Regulations.	22(1)©	✓		9		✓	16	✓		10
Ensure that contractors are informed of the minimum amount of time required for preconstruction planning before actual construction work.	22(1)(f)	✓		18			8	✓		16
Consult contractors where necessary before finalising the part of the construction phase plan relevant to his work.	22(1)(g)	✓		19			3	✓		17
Ensure all contractors have access to the relevant part of the construction phase plan before actual construction work.	22(1)(h)	✓		14		✓	11	✓		15
Ensure contractors are given sufficient time before construction work to prepare and provide welfare facilities and carry out work without risk.	22(1)(i)	✓		17			7	✓		12
Ensure each contractor promptly provides construction activity information likely to be required by the CDM Coordinator for inclusion in the Health and Safety File	22(1)(j)	✓		13			1	✓		13
Ensure project notification particulars displayed in a legible manner to be read by any worker engaged in the construction work.	22(1)(k)	✓		5		✓	19	✓		19
Take reasonable steps to prevent persons	22(1)(l)	✓		6		✓	17	✓		6

	Variables	Discharge			Burdensome			Importance		
Description of duties (Principal Contractor)	**Mean / Reg.**	**≥ 3.5**	**≤ 2.5**	**Rank**	**≥ 3.5**	**≤ 2.5**	**Rank**	**≥ 3.5**	**≤ 2.5**	**Rank**
unauthorised to access the construction site.										
Ensure site induction and training is provided to every worker carrying out the construction work.	22(2)	✓		4		✓	15	✓		1
Prepare the construction phase plan before construction work and pay adequate attention to information provided by the designer.	23(1)(a)	✓		7			4	✓		7
Update, review, and revise the construction phase plan when appropriate throughout the project.	23(1)(b)	✓		12			5	✓		14
Implement the construction phase plan to ensure the health and safety of all persons carrying out the construction work.	23(1)©	✓		3		✓	14	✓		2
Take all reasonable steps to ensure that the construction phase plan identifies the risks to health and safety.	23(2)	✓		10		✓	13	✓		5
Facilitate cooperation with workers engaged in the construction work and developing measures to ensure health, safety, or welfare of workers and checking the effectiveness of such measures.	24(a)	✓		11		✓	12	✓		9
Consult workers or their representatives on matters regarding the project in line with their health, safety, and welfare.	24(b)	✓		15		✓	9	✓		11
Ensure that workers or their representatives can inspect and take copies of any planning and management information, which relates to the project.	24(c)		✓	20		✓	10	✓		20

Considering the perceived degree of difficulty relative to the perceived degree of importance of duties of the CDM-C presents interesting observations. For example, it is surprising to note that despite perceiving the preparation of the H&S File (Regulation 20(2)(e)) and ensuring Designers comply with their duties (Regulation 20(2)(c)) as burdensome, they were still perceived as important and discharged on a frequent basis. Because of the perceived difficulty, an inverse relationship was expected regarding the extent of discharge of these duties, contrary to what the results reveal. Notably though, some duties remained neutral in terms of the perceived degree of difficulty. For example, 4 of 10 duties of the CDM-C were considered neither easy nor difficult to discharge, while 8 of 20 duties of the PC were also neither considered easy nor difficult to discharge.

To illustrate this misalignment in perception as alluded to above, Figure 7.2 compares the extent of discharge of ensuring workers or their representatives can inspect planning information (Regulation 24(c)) and its perceived degree of importance given than it was rated as the least frequently discharged and least important of the PC. It demonstrates the difference between the discharge of this duty and its perceived degree of importance, signalling a misalignment in compliance.

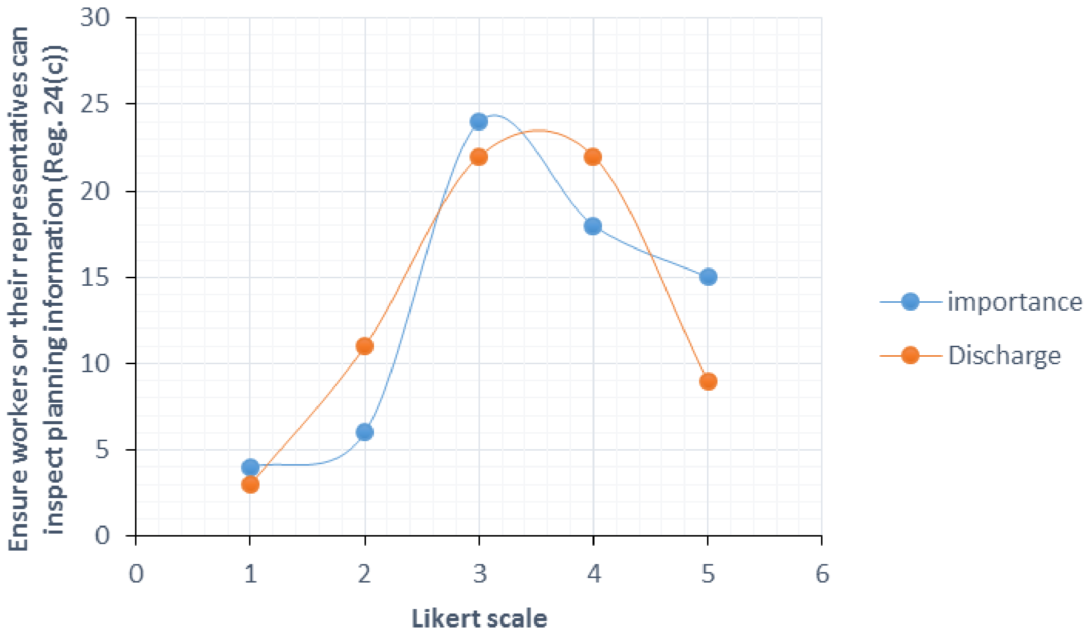

Figure 7.2: Comparison between discharge of duty and perceived degree of importance (Regulation 24(c)).

To ascertain the robustness of the inferences from the ranking of the duties according to the mean, it was necessary to undertake further tests to verify the significance of the observed results statistically. Considering the sample size and existing outliers in the data, the use of nonparametric tests was considered appropriate. Non-parametric tests overcome problems relating to distribution of scores by ranking the data (Field, 2009). Field (2009) recommends using the median to complement such findings. Given the distribution of the scores in the data, the most appropriate method was the Friedman's ANOVA test, where more than two conditions subjected to the same participants are tested (Field, 2009). In this study, the three parameters that apply are: (i) the extent of discharge of duties (dependent variable), (ii) the perceived degree of difficulty (independent variable), and (iii) the perceived degree of importance (independent variable).

Having compared the differences in the mean ranks based on the median scores of the CDM-C's duties, Freidman's test reveals statistically significant differences across the three variables. 90% of the duties of the CDM-C are statistically different. The only exception is the duty to ensure Designers comply with their duties (Regulation 20(2)(c)) which shows an insignificant difference, implying that its extent of discharge is equivalent to the perceived degree of difficulty and importance, $\chi^2(2) = 4.158$, $n = 47$, $p = 0.125$ (see Table 7.20). Generally, it can be concluded from these results that statistically, there is insufficient evidence of a link between the perceived degree of importance and difficulty, and the extent of discharge of duties. In other words, the perceived degree of difficulty does not correspond to the extent of discharge of a particular duty, suggesting that the level of difficulty does not hinder the duty holder from discharging the duty. Similarly, all duties of the PC are statistically significant as detailed in Table 7.21. This demonstrates that statistically, there are significant differences across the three parameters. This also implies that there is insufficient evidence of any association with either parameter. It triggers the need for a thorough inspection of these differences as discussed subsequently.

The preceding findings and observations therefore show statistically significant differences across the three parameters. It is therefore viable to conclude that the perceived degree of difficulty and importance of duties does not necessarily reflect the extent of discharge of duties. However, in order to determine a more precise result in relation to the specific duties, it is recommended to undertake further tests (e.g. Field, 2009; Pallant, 2011). Undertaking further tests provides an opportunity to not only compare the precise impact on the various duties, but also examine the effect size (Field, 2009). An effect size or coefficient of determination is used to explain the variance observed. It is usually derived by squaring the correlation coefficient (r) or dividing the Z-score by the square root of the total number of cases (N) (Pallant, 2011).

Table 7.20: Friedman's test output: median and mean rank comparison (CDM-C duties)

Description of duties	Reg.	Discharge		Burdensome		Importance		Test Statistic	Df	Sig. value
		Median	Mean rank	Median	Mean rank	Median	Mean rank			
Give suitable advice and assistance to the Client regarding compliance with the Clients' duties under the Regulations	20(1)(a)	4.00	2.30	2.00	1.24	4.00	2.46	48.570	2	.000
Ensure arrangements for coordination of health and safety measures during planning and preparation for the construction phase are implemented	20(1)(b)	3.50	1.99	3.00	1.38	5.00	2.633	44.168	2	.000
Liaise with the Principal Contractor regarding information required for the preparation of the Construction Phase Plan, contents of the Health and Safety File and any design development that may affect the planning and management of construction work.	20(1)(c)	5.00	2.33	3.00	1.41	4.00	2.26	35.136	2	.000
Take reasonable steps towards identifying and collecting preconstruction information	20(2)(a)	4.00	2.28	3.00	1.23	4.00	2.49	53.173	2	.000
Promptly provide preconstruction information to all Designers, Contractors and the Principal Contractor.	20(2)(b)	4.00	2.24	3.00	1.24	4.00	2.51	53.932	2	.000
Take reasonable steps to ensure Designers comply with their duties and provide sufficient information about aspects of the design to assist other Designers, Clients, the CDM Coordinator and Contractors	20(2)(c)	4.00	1.85	4.00	1.94	4.00	2.21	4.158*	2	.125
Take all reasonable steps during the construction phase to ensure cooperation between Designers and the Principal Contractor in relation to any design or design change.	20(2)(d)	4.00	2.14	3.00	1.67	4.00	2.19	10.028	2	.007
Prepare where none exists the Health and Safety File and update/review for subsequent construction work.	20(2)(e)	4.00	2.27	4.00	1.73	4.00	2.00	8.562	2	.014
Handover the Health and Safety File to the Client at the end of the construction phase	20(2)(f)	4.00	2.42	3.00	1.39	4.00	2.18	33.646	2	.000
Ensure notice is given to the Health and Safety Executive (or Office of Rail Regulation)	21(1)	5.00	2.70	1.00	1.10	4.00	2.21	73.200	2	.000

(*Same distribution)

Table 7.21: Friedman's test output: median and mean rank comparison (PC duties)

Description of duties	Reg.	Discharge		Burdensome		Importance		Test Statistic	Df	Sig. value
		Median	Mean rank	Median	Mean rank	Median	Mean rank			
Ensure that the construction phase is planned, managed, and monitored in a reasonably practicable manner, while facilitating cooperation and coordination between contractors and pursuance of the general principles of prevention.	22(1)(a)	5.00	2.31	2.50	1.20	5.00	2.49	80.479	2	.000
Liaise with the CDM Coordinator and Designers regarding any design/or change to design during the construction phase.	22(1)(b)	4.00	2.17	3.00	1.63	4.00	2.20	16.898	2	.000
Ensure provision of adequate welfare facilities throughout the construction phase.	22(1)(c)	5.00	2.55	2.00	1.08	5.00	2.37	103.377	2	.000
Draw up site rules where	22(1)(d)	5.00	2.61	1.00	1.05	5.00	2.34	104.982	2	.000

Description of duties	Reg.	Discharge Median	Discharge Mean rank	Burdensome Median	Burdensome Mean rank	Importance Median	Importance Mean rank	Test Statistic	Df	Sig. value
necessary for health and safety, appropriate to the construction site/activities.										
Offer reasonable directions to any contractor when necessary to enable compliance with his duties under the Regulations.	22(1)(e)	5.00	2.48	2.00	1.17	4.00	2.35	83.924	2	.000
Ensure that contractors are informed of the minimum amount of time required for preconstruction planning before actual construction work.	22(1)(f)	4.00	2.23	3.00	1.40	4.00	2.37	45.656	2	.000
Consult contractors where necessary before finalising the part of the construction phase plan relevant to his work.	22(1)(g)	4.00	2.01	3.00	1.69	4.00	2.30	15.610	2	.000
Ensure all contractors have access to the relevant part of the construction phase plan before actual construction work.	22(1)(h)	4.00	2.25	2.00	1.41	4.00	2.34	45.761	2	.000
Ensure contractors are given sufficient time before construction work to prepare and provide welfare facilities and carry out work without risk.	22(1)(i)	4.00	2.11	3.00	1.49	4.00	2.40	34.389	2	.000
Ensure each contractor promptly provides construction activity information likely to be required by the CDM Coordinator for inclusion in the Health and Safety File	22(1)(j)	4.00	2.07	4.00	1.77	4.00	2.16	7.292	2	.026
Ensure project notification particulars are displayed in a legible manner to be read by any worker engaged in the construction work.	22(1)(k)	5.00	2.68	2.00	1.18	4.00	2.14	86.565	2	.000
Take reasonable steps to prevent persons unauthorised to access the construction site.	22(1)(l)	5.00	2.50	2.00	1.07	5.00	2.43	106.869	2	.000
Ensure site induction and training is provided to every worker carrying out the construction work.	22(2)	5.00	2.43	2.00	1.14	5.00	2.42	96.251	2	.000
Prepare the construction phase plan before construction work and pay adequate attention to information provided by the designer.	23(1)(a)	5.00	2.37	2.50	1.27	5.00	2.36	69.186	2	.000
Update, review, and revise the construction phase plan when appropriate throughout the project.	23(1)(b)	4.00	2.27	3.00	1.42	4.00	2.32	44.149	2	.000
Implement the construction phase plan to ensure the health and safety of all persons carrying out the construction work.	23(1)(c)	5.00	2.47	2.00	1.11	5.00	2.42	98.604	2	.000
Take all reasonable steps to ensure that the construction phase plan identifies the risks to health and safety	23(2)	5.00	2.35	2.00	1.21	5.00	2.44	79.079	2	.000
Facilitate cooperation with workers engaged in the construction work and developing measures to ensure health, safety, or welfare of workers and checking the effectiveness of such measures.	24(a)	4.00	2.32	2.00	1.27	4.00	2.41	66.488	2	.000
Consult workers or their representatives on matters regarding the project in line with their health, safety, and welfare.	24(b)	4.00	2.14	2.50	1.45	4.00	2.42	39.991	2	.000
Ensure workers/representatives can inspect planning and management information.	24(c)	3.00	2.15	2.00	1.59	3.00	2.25	21.172	2	.000

To examine the precise differences across the three conditions (or variables) requires carefully comparing the variables in pairs. Two sets of scores coming from the same participants, invite the application of the Wilcoxon signed rank test (Field, 2009; Pallant, 2011). It is the non-parametric equivalent of the *t*-test (Tabachnick and Fidell, 2007; Field, 2013) as established already in the research design chapter (see Section 5.7.1).

7.7.1 Comparison of paired median scores: duties of the CDM-C

The results show a significant decline in the median scores between the extent of discharge of duties and the perceived degree of difficulty (or burdensome). Further, 90% (i.e. 9 of 10) of the duties are statistically significant (see Table 7.22a); excluding taking reasonable steps to ensure Designers comply with their duties (Regulation 20(2)(c)).

Table 7.22a: Comparison of median scores (Wilcoxon signed ranked test, CDM-C duties-discharge/difficulty)

Description of duties	Reg.	*Z Score*	*Sig. value*	Median (discharge)	Median (difficulty)	*Effect size (r)*
Give suitable advice and assistance to the Client regarding compliance with the Clients' duties under the Regulations.	20(1)(a)	-4.993	.000	4.00	4.00	
Ensure that arrangements for coordination of health and safety measures during planning and preparation for the construction phase are implemented	20(1)(b)	-3.940	.000	3.50	3.00	
Liaise with the Principal Contractor regarding information required for the preparation of the Construction Phase Plan, contents of the Health and Safety File and any design development that may affect the planning and management of construction work.	20(1)(c)	-4.403	.000	5.00	3.00	
Take reasonable steps towards identifying and collecting preconstruction information	20(2)(a)	-4.804	.000	4.00	3.00	
Promptly provide preconstruction information to all Designers, Contractors and the Principal Contractor.	20(2)(b)	-4.866	.000	4.00	3.00	
Take reasonable steps to ensure Designers comply with their duties and provide sufficient information about aspects of the design to assist other Designers, Clients, the CDM Coordinator and Contractors	20(2)(c)	-.661	.509	4.00	2.00	0.068
Take all reasonable steps during the construction phase to ensure cooperation between Designers and the Principal Contractor in relation to any design or design change.	20(2)(d)	-2.367	.018	4.00	3.00	
Prepare where none exists the Health and Safety File and update/review for subsequent construction work.	20(2)(e)	-2.825	.005	4.00	2.00	
Handover the Health and Safety File to the Client at the end of the construction phase	20(2)(f)	-4.783	.000	4.00	3.00	
Ensure notice is given to the Health and Safety Executive (or Office of Rail Regulation)	21(1)	-6.120	.000	5.00	5.00	

Additionally, of the nine statistically significant comparisons, two return the same median score (i.e. giving suitable advice and assistance to the client (Regulation 20(a) and ensuring notice is given to the relevant authority (Regulation 21 (1)). However, of more importance, is the insignificant result. Taking reasonable steps to ensure Designers comply with their duties (Regulation 20(2)(c)), returns a Z-score of - 0.661, p = 0.509 and r = 0.068 (see Table 22a). This signals that its extent of discharge is tantamount to the perceived degree of difficulty even though the effect size calculated is small, going by Cohen's explanation (Cohen, 1988).

Table 7.22b: Comparison of median scores (Wilcoxon signed ranked test, CDM-C duties-discharge/importance)

Description of duties	**Reg.**	***Z* *Score***	***Sig. value***	**Median (discharge)**	**Median (importance)**	***Effect size (r)***
Give suitable advice and assistance to the Client regarding compliance with the Clients' duties under the Regulations	20(1)(a)	-.266	.790	4.00	4.00	0.027
Ensure that arrangements for coordination of health and safety measures during planning and preparation for the construction phase are implemented	20(1)(b)	-3.711	.000	3.50	5.00	
Liaise with the Principal Contractor regarding information required for the preparation of the Construction Phase Plan, contents of the Health and Safety File and any design development that may affect the planning and management of construction work.	20(1)(c)	-.334	.739	5.00	4.00	0.034
Take reasonable steps towards identifying and collecting preconstruction information	20(2)(a)	-1.350	.177	4.00	4.00	0.14
Promptly provide preconstruction information to all Designers, Contractors and the Principal Contractor.	20(2)(b)	-2.183	.029	4.00	4.00	
Take reasonable steps to ensure Designers comply with their duties and provide sufficient information about aspects of the design to assist other Designers, Clients, the CDM Coordinator and Contractors	20(2)(c)	-2.238	.025	4.00	4.00	
Take all reasonable steps during the construction phase to ensure cooperation between Designers and the Principal Contractor in relation to any design or design change.	20(2)(d)	-.879	.380	4.00	4.00	0.09
Prepare where none exists the Health and Safety File and update/review for subsequent construction work.	20(2)(e)	-1.351	.177	4.00	4.00	0.14
Handover the Health and Safety File to the Client at the end of the construction phase	20(2)(f)	-2.082	.037	4.00	4.00	
Ensure notice is given to the Health and Safety Executive (or Office of Rail Regulation)	21(1)	-3.824	.000	5.00	4.00	

On the other hand, comparing the extent of discharge of duties and the perceived degree of importance yields five statistically significant pairs, while the remaining five return an insignificant outcome (see Table 7.22b above). It is therefore plausible to argue that the extent of discharge of the following duties is misaligned with their perceived degree of importance. These duties are:

(i) ensuring arrangements for coordination of H&S measures (Regulation 20(1)(b));

(ii) promptly providing preconstruction information (Regulation 20(2)(b));

(iii) taking reasonable steps to ensure Designers comply with their duties (Regulation 20(2)(c));

(iv) handing over the H&S File to the Client (Regulation 20(2)(f)); and

(v) ensuring notice is given to the relevant authority (Regulation 21(1)).

In other words, 50% (i.e. 5 of 10) of the duties of the CDM-C are misaligned in terms of their perceived degree of importance to impact H&S management.

7.7.2 Comparison of paired median scores: duties of the PC

A comparison between the extent of discharge of duties and the perceived degree of difficulty shows that all the PC duties return a statistically significant result. This means that the differences between the scores are statistically significant and as such, the extent of discharge of these duties is not impeded by their perceived degree of difficulty to discharge (see Table 7.23a). Additionally, since all the pairs of comparisons show a significant result, it is unnecessary to determine the effect size.

On the other hand, a close inspection of the results regarding the extent of discharge of duties and their perceived degree of importance shows that five pairs are statistically significant (see Table 7.23b). This implies that the extent of discharge is misaligned with the perceived degree of importance of:

(i) drawing up site rules for H&S (Regulation 22(1)(d));

(ii) consulting contractors where necessary (Regulation 22(1)(g));

(iii) ensuring contractors are given sufficient time before construction (Regulation 22(1)(i));

(iv) ensuring project notification particulars are displayed (Regulation 22(1)(k)); and

(v) consulting workers or their representatives (Regulation 24(b)).

This means that 25% (i.e. 5 of 20) of the duties of the PC are misaligned in terms of their impact on H&S management. Based on these comparisons and foregoing discussion, it is clear, that in some instances the perceived degree of importance and the perceived degree of difficulty remain tantamount to the extent of discharge of duties. However, further investigation is required, to determine the strength of such relationships between the dependent and independent variables, as tackled in Section 7.8.

Table 7.23a: Comparison of median scores (Wilcoxon signed ranked test, PC duties-discharge/difficulty)

Description of duties	Reg.	Z Score	Sig. value	Median (discharge)	Median (difficulty)
Ensure that the construction phase is planned, managed, and monitored in a reasonably practicable manner, while facilitating cooperation and coordination between contractors and pursuance of the general principles of prevention.	22(1)(a)	-6.411	.000	5.00	3.50
Liaise with the CDM Coordinator and Designers regarding any design/or change to design during the construction phase.	22(1)(b)	-2.827	.005	4.00	3.00
Ensure provision of adequate welfare facilities throughout the construction phase.	22(1)(c)	-7.041	.000	5.00	4.00
Draw up site rules where necessary for health and safety, appropriate to the construction site/activities.	22(1)(d)	-7.115	.000	5.00	5.00
Offer reasonable directions to any contractor when necessary to enable compliance with his duties under the Regulations.	22(1)(e)	6.572	.000	5.00	4.00
Ensure that contractors are informed of the minimum amount of time required for preconstruction planning before actual construction work.	22(1)(f)	-5.044	.000	4.00	3.00
Consult contractors where necessary before finalising the part of the construction phase plan relevant to his work.	22(1)(g)	-2.637	.008	4.00	3.00
Ensure all contractors have access to the relevant part of the construction phase plan before actual construction work.	22(1)(h)	-5.210	.000	4.00	4.00
Ensure contractors are given sufficient time before construction work to prepare and provide welfare facilities and carry out work without risk.	22(1)(i)	-4.139	.000	4.00	3.00
Ensure each contractor promptly provides construction activity information likely to be required by the CDM Coordinator for inclusion in the Health and Safety File	22(1)(j)	-2.490	.013	4.00	2.00
Ensure project notification particulars displayed in a legible manner to be read by any worker engaged in the construction work.	22(1)(k)	-6.905	.000	5.00	4.00
Take reasonable steps to prevent persons unauthorised to access the construction site.	22(1)(l)	-6.938	.000	5.00	4.00
Ensure site induction and training is provided to every worker carrying out the construction work.	22(2)	-6.624	.000	5.00	4.00
Prepare the construction phase plan before construction work and pay adequate attention to information provided by the designer.	23(1)(a)	-5.927	.000	5.00	3.50
Update, review, and revise the construction phase plan when appropriate throughout the project.	23(1)(b)	-5.490	.000	4.00	3.00
Implement the construction phase plan to ensure the health and safety of all persons carrying out the construction work.	23(1)(c)	-6.866	.000	5.00	4.00
Take all reasonable steps to ensure that the construction phase plan identifies the risks to health and safety.	23(2)	-6.382	.000	5.00	4.00
Facilitate cooperation with workers engaged in the construction work and developing measures to ensure health, safety, or welfare of workers and checking the effectiveness of such measures.	24(a)	-6.010	.000	4.00	4.00
Consult workers or their representatives on matters regarding the project in line with their health, safety, and welfare.	24(b)	-4.702	.000	4.00	3.50
Ensure that workers or their representatives can inspect and take copies of any planning and management information, which relates to the project.	24(c)	-3.819	.000	3.00	4.00

Table 7.23b: Comparison of median scores (Wilcoxon signed ranked test, PC duties-discharge/importance)

Description of duties	Reg.	Z Score	Sig. value	Median (discharge)	Median (importance)	Effect size (*r*)
Ensure that the construction phase is planned, managed, and monitored in a reasonably practicable manner, while facilitating cooperation and coordination between contractors and pursuance of the general principles of prevention.	22(1)(a)	-1.912	.056	5.00	5.00	0.165
Liaise with the CDM Coordinator and Designers regarding any design/or change to design during the construction phase.	22(1)(b)	-.752	.452	4.00	4.00	0.065
Ensure provision of adequate welfare facilities throughout the construction phase.	22(1)(c)	-1.874	.061	5.00	5.00	0.162
Draw up site rules where necessary for health and safety, appropriate to the construction site/activities.	22(1)(d)	-2.623	.009	5.00	5.00	
Offer reasonable directions to any contractor when necessary to enable compliance with his duties under the Regulations.	22(1)(e)	-1.529	.126	5.00	4.00	0.132
Ensure contractors are informed of the minimum amount of time required for preconstruction planning before actual construction work.	22(1)(f)	-1.459	.145	4.00	4.00	0.126
Consult contractors where necessary before finalising the part of the construction phase plan relevant to his work.	22(1)(g)	-2.606	.009	4.00	4.00	
Ensure all contractors have access to the relevant part of the construction phase plan before actual construction work.	22(1)(h)	-.637	.524	4.00	4.00	0.055
Ensure contractors are given sufficient time before construction work to prepare and provide welfare facilities and carry out work without risk.	22(1)(i)	-2.030	.042	4.00	4.00	
Ensure each contractor promptly provides construction activity information likely to be required by the CDM Coordinator for inclusion in the Health and Safety File	22(1)(j)	-.648	.517	4.00	4.00	0.056
Ensure project notification particulars displayed in a legible manner to be read by any worker engaged in the construction work.	22(1)(k)	-3.965	.000	5.00	4.00	
Take reasonable steps to prevent persons unauthorised to access the construction site.	22(1)(l)	-.912	.362	5.00	5.00	0.079
Ensure site induction and training is provided to every worker carrying out the construction work.	22(2)	-.065	.948	5.00	5.00	0.005
Prepare the construction phase plan before construction work and pay adequate attention to information provided by the designer.	23(1)(a)	-.289	.773	5.00	5.00	0.025
Update, review, and revise the construction phase plan when appropriate throughout the project.	23(1)(b)	-.073	.942	4.00	4.00	0.006
Implement the construction phase plan to ensure the health and safety of all persons carrying out the construction work.	23(1)(c)	-.660	.509	5.00	5.00	0.057
Take all reasonable steps to ensure that the construction phase plan identifies the risks to health and safety.	23(2)	-.638	.524	5.00	5.00	0.056
Facilitate cooperation with workers engaged in the construction work and developing measures to ensure health, safety, or welfare of workers and checking the effectiveness of such measures.	24(a)	-.599	.549	4.00	4.00	0.052
Consult workers or their representatives on matters regarding the project in line with their health, safety, and welfare.	24(b)	-1.960	.050	4.00	4.00	
Ensure that workers or their representatives can inspect and take copies of any planning and management information, which relates to the project.	24(c)	-.914	.361	3.00	3.00	0.079

7.8 CORRELATION BETWEEN THE EXTENT OF DISCHARGE OF DUTIES AND THE PERCEIVED DEGREE OF IMPORTANCE AND DIFFICULTY: FINDINGS AND DISCUSSION

Hair *et al.* (2008) define the correlation coefficient (*r*) as an indication of the strength of an association or linear relationship between the dependent and independent variables. A negative or positive sign in this regard indicates the direction of the relationship.

For example, +1 indicates a perfect positive relationship, while -1 indicates a perfect negative relationship, and 0 indicates no relationship at all. The violation of assumptions such as skewedness of the data yielding a non-normal distribution as discussed in Chapter 5, invites application of a non-parametric correlation method, rather than the parametric Pearson's *r* correlation method. An examination of the correlation results reveals the existence of some degree of association between the extent of discharge of duties and the perceived degree of importance. For example, discharging the CDM-C duty to provide preconstruction information (Regulation 20(2)(b)) shows a positive association with the perceived degree of importance of preparing the H&S File (Regulation 20(2)(e)) (see Figure 7.3).

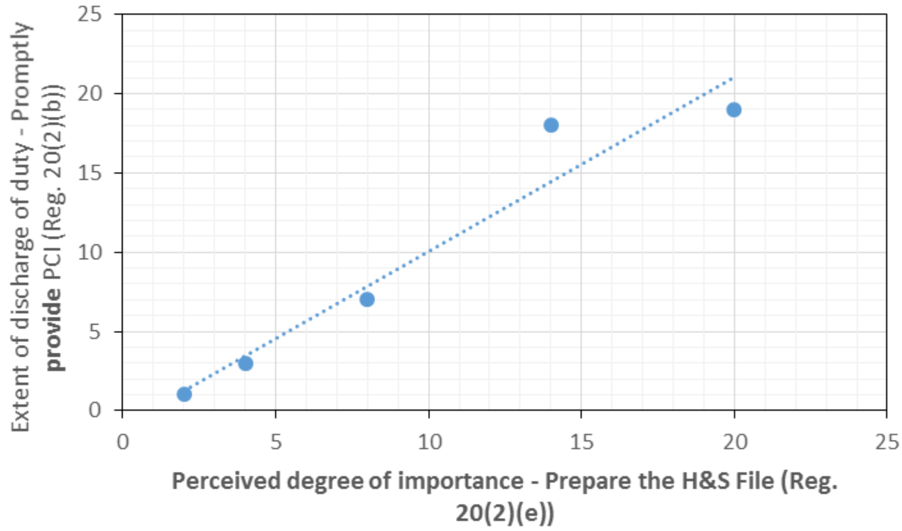

Figure 7.3: Correlation between discharge of Regulation 20(2)(b) and perceived degree of importance of Regulation 20(2)(e))

Similarly, the extent of discharge of taking steps to encourage cooperation between the Designer and the PC (Regulation 20(2)(d)) and the perceived degree of importance of promptly providing preconstruction information (Regulation 20(2)(b)), also shows a positive relationship (see Figure 7.4). These significant relationships demonstrate the existence of associations between the dependent variable (i.e. extent of discharge of duties) and the independent variables (i.e. perceived degree of importance and difficulty to discharge duties); thus invite further exploration of the primary data, to establish the degree of associations and implications for practice.

Field (2013) provides a comprehensive guide of how to undertake a correlation analysis, in this case utilising a non-parametric method as explained earlier. He further argues that despite the common use of the spearman's correlation coefficient, a more robust method to adopt is the Kendall's tau correlation because of its ability to draw more accurate and robust results. Thus, the results reported in this section, apply to the Kendall's tau test (cf. Howell, 1997).

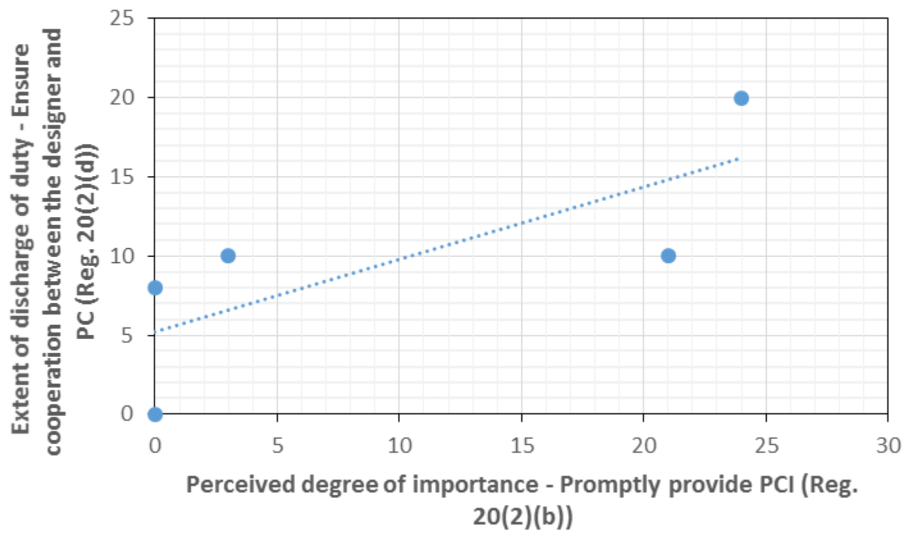

Figure 7.4: Correlation between discharge of Regulation 20(2)(d) and perceived degree of importance of Regulation 20(2)(b))

Additionally, to interpret the results, Cohen's explanation to determine the effect size, widely accepted by various authors (e.g. Myers and Well, 2003; Tabachnick and Fidell, 2007; Field, 2009; Pallant, 2011) is adopted. This requires interpretation of the correlation coefficient (*r*) or strength of the relationship as follows:

- r = ±.10 to .29 (weak/small strength—in this case .10 explains 1% of the shared variance)

- r = ±.30 to .49 (moderate/medium strength—in this case .30 explains 9% of the shared variance)
- r = ±.50 to 1.0 (strong/large strength—in this case .05 explains 25% of the shared variance).

7.8.1 Linear relationships between the extent of discharge of duties by the CDM-C and the perceived degree of importance and difficulty

7.8.1.1 Correlation between extent of discharge of duties and perceived degree of importance (CDM-C)

The correlation analysis between the extent of discharge of the CDM-C's duties and the perceived degree of importance yielded six positive relationships. Two are of moderate strength and four are of weak strength as listed below:

- promptly provide preconstruction information (Regulation 20(2)(b)) and prepare the H&S File (Regulation (20(2)(e)) (r = .348, p = .005, n = 48, significant at the level 0.01);
- ensure cooperation between the Designer and PC (Regulation 20(2)(d)) and promptly provide preconstruction information (Regulation 20(2)(b)) (r = .314, p = .017, n = 48, significant at the level 0.05);
- take reasonable steps to ensure that the Designer complies with his duties (Regulation 20(2)(c)) and promptly provide preconstruction information (Regulation 20(2)(b)) (r = .297, p = .023, n = 48, significant at the level 0.05);
- promptly provide preconstruction information (PCI) (Regulation 20(2)(b)) and promptly provide preconstruction information (Regulation 20(2)(b)) (r = .296, p = .026, n = 48, significant at the level 0.05);

- liaise with the PC (Regulation 20(1)(c)) and liaise with the PC (Regulation 20(1)(c)) (r = .292, p = .028, n = 48, significant at the level 0.05);
- ensure cooperation between the Designer and PC (Regulation 20(2)(d)) and liaise with PC (Regulation 20(1)(c)) (r = .256, p = 0.38, n = 48, significant at the level 0.05).

Notably, only two relationships show that, the duty that is being discharged, is associated with its perceived degree of importance (i.e. liaising with the PC—Regulation 20(1)(c) and promptly provide PCI—Regulation 20(2)(b)). This outcome suggests that its discharge on one hand positively corresponds to the perceived degree of importance on the other. The other statistically significant relationships demonstrate that the extent of discharge of duties relates to the perceived degree of importance of another duty besides itself (see Table 7.24). The statistically significant relationships between the dependent (i.e. extent of discharge of duties) and independent (i.e. perceived degree of importance/difficulty) variables are in asterisks. From the evidence, provision of preconstruction information (Regulation 20(2)(b)) has the highest number of associations, which signals its importance. Further inspection of the associations also reveals the significance of engaging with other project stakeholders demonstrated by the statistically significant relationships. This issue reinforces the aspect of cooperation and collaboration, a key requirement defined within the CDM 2007. It is consistent with the notion that the success of integrating H&S into planning, design and construction hinges on a collaborative approach (e.g. Webster, 2013).

Whilst the importance of engaging with other project stakeholders is observed from the correlation analysis, contrary to these findings, it is reported on a number of occasions that there is minimal presence of the CDM-C on site (e.g. SEC, 2010; ICE, 2011), evidence of their lack of engagement with other stakeholders and the project as a whole. Some respondents appointed in the role of PC, shared the same views as illustrated below:

> *...speaking as a site manager, they are not really perceived as great contributors to a project. There is no criterion for CDM-Cs; the last guy who carried out the CDM-C duties on my last project is no health and safety professional, although he does have CSCS* [PC Respondent 31].

> *More of a role during construction—i.e. should attend site meetings; better qualification for the role; better information packs, mostly generic rubbish* [PC Respondent 47].

Table 7.24: Correlation matrix: extent of discharge of duties and perceived degree of importance (CDM-C)

Discharge of duties \ Perceived degree of importance		20(1)(a)	20(1)(b)	20(2)(a)	20(2)(b)	21(1)	20(1)(c)	20(2)(c)	20(2)(d)	20(2)(e)	20(2)(f)
20(1)(a)	*Correlation Coefficient*	.022	-.045	.047	.204	-.011	-.108	.097	.166	-.155	-.174
	Sig. (2-tailed)	.863	.724	.716	.123	.928	.406	.444	.193	.216	.162
	N	48	48	48	48	48	47	48	48	48	48
20(1)(b)	*Correlation Coefficient*	-.018	.121	.154	.157	.089	.146	.221	.237	.137	.146
	Sig. (2-tailed)	.887	.346	.237	.235	.474	.262	.083	.063	.274	.243
	N	48	48	48	48	48	47	48	48	48	48
20(2)(a)	*Correlation Coefficient*	.196	-.005	.204	.146	.117	.156	.072	.073	.182	.086
	Sig. (2-tailed)	.122	.966	.120	.273	.351	.234	.576	.568	.149	.495
	N	48	48	48	48	48	47	48	48	48	48
20(2)(b)	*Correlation Coefficient*	.199	-.074	.084	***.296****	.055	.018	-.035	.123	***.348*****	.164
	Sig. (2-tailed)	.115	.565	.517	.026	.657	.891	.785	.335	.005	.188
	N	48	48	48	48	48	47	48	48	48	48
21(1)	*Correlation Coefficient*	-.115	-.192	.021	-.126	.013	-.014	-.200	-.151	-.089	-.057
	Sig. (2-tailed)	.396	.165	.883	.375	.924	.921	.144	.271	.508	.673
	N	47	47	47	47	47	46	47	47	47	47
20(1)(c)	*Correlation Coefficient*	.089	.010	.029	.149	.228	***.292****	.100	.205	.021	.059
	Sig. (2-tailed)	.489	.940	.830	.271	.072	.028	.440	.114	.869	.644
	N	48	48	48	48	48	47	48	48	48	48
20(2)(c)	*Correlation Coefficient*	.232	.051	.056	***.297****	.070	.167	.144	.160	.056	-.013
	Sig. (2-tailed)	.062	.690	.660	.023	.567	.195	.251	.204	.652	.915
	N	48	48	48	48	48	47	48	48	48	48
20(2)(d)	*Correlation Coefficient*	.189	.054	.113	***.314****	***.256****	.189	.197	.124	.082	.161
	Sig. (2-tailed)	.129	.672	.381	.017	.038	.143	.117	.326	.507	.191

Perceived degree of importance / Discharge of duties		**20(1)(a)**	**20(1)(b)**	**20(2)(a)**	**20(2)(b)**	**21(1)**	**20(1)(c)**	**20(2)(c)**	**20(2)(d)**	**20(2)(e)**	**20(2)(f)**
	N	48	48	48	48	48	47	48	48	48	48
20(2)(e)	*Correlation Coefficient*	-.036	-.035	.084	.151	-.057	.160	.201	.068	.103	-.033
	Sig. (2-tailed)	.780	.791	.524	.259	.652	.225	.118	.599	.415	.792
	N	48	48	48	48	48	47	48	48	48	48
20(2)(f)	*Correlation Coefficient*	.240	-.136	-.076	.118	.050	-.015	.023	.199	.053	.223
	Sig. (2-tailed)	.063	.300	.567	.384	.692	.913	.859	.126	.679	.080
	N	48	48	48	48	48	47	48	48	48	48

(Refer to Section 4.4.1.5 for description of duties of the CDM-C, *significant at 0.05 level, **significant at the 0.01 level, green: positive correlation, red: negative correlation)

7.8.1.2 Correlation between extent of discharge of duties and perceived degree of difficulty (CDM-C)

Analysis of the association between the extent of discharge of duties and the perceived degree of difficulty yields six statistically significant relationships (i.e. one positive moderate strength, two positive weak strength, and three negative associations of a weak strength). The statistically significant positive relationships mean that there is an increase in the extent of discharge of duties and the perceived degree of difficulty at the same time. While a negative relationship means that, a decrease in the extent of discharge of a particular duty is associated with an increase in the perceived degree of difficulty of another. The relationships observed are listed below:

- give suitable advice to client (Regulation 20(1)(a)) and take reasonable steps to ensure cooperation between Designer and PC when considering design changes (Regulation 20(2)(d)) (r = .271, p = .030, n = 47, significant at level 0.05);
- identifying and collecting PCI (Regulation 20(2)(a)) and liaise with the PC (Regulation 20(1)(c)) (r = .314, p = .012, n = 47, significant at level 0.05);
- notify project to HSE (Regulation 21(1)) and liaise with the PC (Regulation 20(1)(c)) (r = .282, p = .035, n = 46, significant at level 0.05);

- promptly provide PCI (Regulation 20(2)(b)) and ensure arrangements for coordination (Regulation 20(1)(b)) (r = -.289, p = .022, n = 47, significant at level 0.05);
- take reasonable steps to ensure cooperation between Designer and PC when considering design changes (Regulation 20(2)(d)) and promptly provide preconstruction information (Regulation 20(2)(b)) (r = -.260, p = .037, n = 47, significant at level 0.05); and
- handover H&S File (Regulation 20(2)(f)) and promptly provide preconstruction information (Regulation 20(2)(b)) (r = -.256, p = .047, n = 47, significant at level 0.05).

The trend observed from the latter three correlations means that the statistical significance is negative, as such inversely associated (see Table 7.25). In other words, an increase in the difficulty corresponds with a greater level of discharge. Notably, since all the three duties increasing in difficulty relate to cooperation and collaboration with other duty holders, it is reasonable to suggest that this finding is consistent with the view suggesting collaboration challenges (see Section 7.4), going by the variance explained.

Table 7.25: Correlation matrix: extent of discharge of duties and perceived degree of difficulty (CDM-C)

Discharge of duties \ Perceived degree of importance		20(1)(a)	20(1)(b)	20(2)(a)	20(2)(b)	21(1)	20(1)(c)	20(2)(c)	20(2)(d)	20(2)(e)	20(2)(f)
20(1)(a)	*Correlation Coefficient*	-.230	-.103	-.035	.061	-.086	.161	.067	***.271****	.118	.016
	Sig. (2-tailed)	.072	.416	.782	.631	.514	.196	.593	.030	.346	.901
	N	47	47	47	47	47	47	47	47	46	46

Perceived degree of importance / Discharge of duties	20(1)(b)			20(2)(a)			20(2)(b)			21(1)			20(1)(c)			20(2)(c)	
	Correlation Coefficient	*Sig. (2-tailed)*	*N*	*Correlation Coefficient*	*Sig. (2-tailed)*	*N*	*Correlation Coefficient*	*Sig. (2-tailed)*	*N*	*Correlation Coefficient*	*Sig. (2-tailed)*	*N*	*Correlation Coefficient*	*Sig. (2-tailed)*	*N*	*Correlation Coefficient*	*Sig. (2-tailed)*
20(1)(a)	-.075	.560	47	-.113	.380	47	-.073	.568	47	.052	.704	46	-.037	.780	47	.017	.895
20(1)(b)	-.237	.061	47	-.183	.152	47	-.207	.103	47	.172	.208	46	-.191	.140	47	-.174	.163
20(2)(a)	-.160	.206	47	-.115	.364	47	***-.289****	.022	47	.023	.864	46	-.100	.438	47	-.110	.377
20(2)(b)	-.221	.081	47	-.067	.599	47	-.183	.149	47	.042	.759	46	-.139	.284	47	-.081	.515
21(1)	-.005	.971	47	-.088	.510	47	-.036	.784	47	-.243	.088	46	-.022	.873	47	-.041	.753
20(1)(c)	.133	.287	47	***.314****	.012	47	.101	.418	47	***.282****	.035	46	.143	.262	47	.022	.858
20(2)(c)	-.208	.096	47	-.084	.501	47	-.057	.649	47	.126	.346	46	-.005	.967	47	-.173	.159
20(2)(d)	-.019	.878	47	-.050	.689	47	-.038	.759	47	-.036	.786	46	-.015	.907	47	-.081	.509
20(2)(e)	.065	.608	46	.136	.284	46	.037	.771	46	.105	.436	45	.011	.931	46	.071	.569
20(2)(f)	.079	.529	46	.039	.760	46	.064	.610	46	-.015	.911	45	.159	.216	46	-.065	.596

Perceived degree of importance / Discharge of duties		20(2)(d)			20(2)(e)			20(2)(f)		
	N	*Correlation Coefficient*	*Sig. (2-tailed)*	*N*	*Correlation Coefficient*	*Sig. (2-tailed)*	*N*	*Correlation Coefficient*	*Sig. (2-tailed)*	*N*
20(1)(a)	47	.036	.774	47	.001	.992	47	.097	.459	47
20(1)(b)	47	-.182	.145	47	-.156	.223	47	-.205	.114	47
20(2)(a)	47	-.209	.093	47	-.028	.826	47	-.245	.057	47
20(2)(b)	47	-.260*	.037	47	-.157	.219	47	-.256*	.047	47
21(1)	47	-.110	.398	47	-.018	.894	47	-.045	.739	47
20(1)(c)	47	-.017	.889	47	.039	.757	47	-.224	.078	47
20(2)(c)	47	-.192	.119	47	-.045	.718	47	-.107	.402	47
20(2)(d)	47	-.119	.334	47	-.185	.143	47	-.036	.775	47
20(2)(e)	46	-.078	.531	46	-.144	.259	46	-.083	.522	46
20(2)(f)	46	.023	.853	46	.084	.508	46	-.228	.077	46

(Refer to subsection 4.4.1.5 for the description of duties of the CDM-C, *significant at 0.05 level, **significant at the 0.01 level, green: positive correlation, red: negative correlation)

7.8.2 Linear relationships between the extent of discharge of duties by the PC and the perceived degree of importance and difficulty

Duties of the PC equally demand engaging with other project stakeholders. The PC has more duties than the CDM-C as already established in Chapter 4. Unsurprisingly, all these duties require engaging with other key project stakeholders as well as workers. This section examines the associations between the extent of discharge of duties and the perceived degree of importance and difficulty encountered. An inspection of the emerging significant relationships reveals the existence of both positive (direct) and negative (inverse) associations (see Table 7.26). An example a positive association is between the discharge of ensuring the construction phase plan identifies risks (Regulation 23(2)) and the perceived degree of importance of ensuring the construction phase is planned and monitored (Regulation 22(1)(a) (see Figure 7.5).

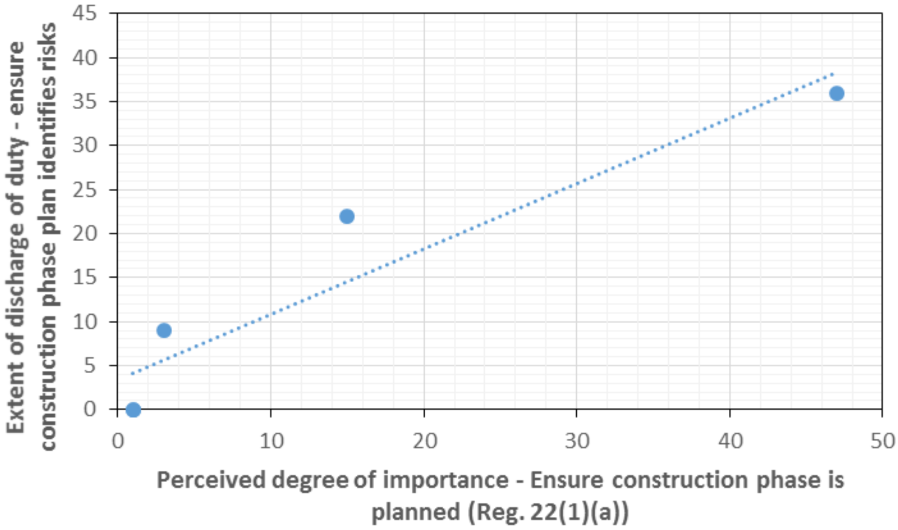

Figure 7.5: Correlation between discharge of Regulation 23(2) and perceived degree of importance of Regulation 22(1)(a)

Whereas the positive relationship entails an increase in both variables, the opposite occurs where the direction of the relationship is negative as already expressed in the preceding subsection. Figure 7.6 on the other hand illustrates the existence of a relationship that is negative in direction. In this particular example, it means that a decrease in the discharge of consulting workers or their representatives (Regulation 24(b)) is associated with an increase of the perceived degree of difficulty to discharge the same duty. To reiterate, these emerging relationships are not causal *per-se*, but rather provide an insight into the strength of an association that exists between the derived variables (see Field, 2009).

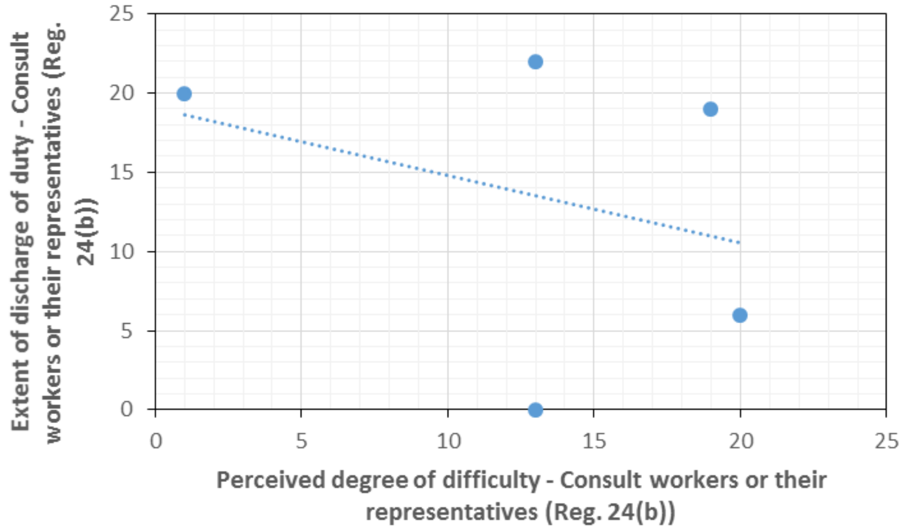

Figure 7.6: Correlation between discharge of Regulation 24(b) and perceived degree of difficulty of Regulation 24(b)

7.8.2.1 Correlation between the extent of discharge of duties and perceived degree of importance (PC)

The correlation between the extent of discharge of PC duties and the perceived degree of importance reveals 71 statistically significant positive relationships (see Table 7.26). 18 (25%) are of a moderate strength and 53 (75%) are of a weak strength. Of the 18 moderate relationships, the perceived degree of importance of ensuring contractors has access to the relevant parts of the construction phase plan (Regulation 22(1)(h)), had the highest number of relationships with five different discharged duties. Ensuring the construction phase plan identifies risks (Regulation 23(2)) and ensuring the construction phase is planned (Regulation 22(1)(a)) both had three positive relationships with various discharged duties. The perceived degree of importance of consulting contractors (Regulation 22(1)(g)) and ensuring site induction and training (Regulation 22(2)), each had two positive relationships with the discharge of various duties. The perceived degree of importance of ensuring the provision of adequate welfare facilities (Regulation 22(1)(c)) had a positive association with the discharge of providing direction to contractors (Regulation 22(1)(e)).

Other duties, which had a statistically significant relationship each, were the discharge of consulting workers (Regulation 24(b)) with the perceived degree of importance of: facilitating cooperation with workers (Regulation 24(a)) and the discharge of ensuring workers can inspect planning information (Regulation 24(c)) with the perceived degree of importance of the same duty.

Notably, five pairs of relationships are highly statistically significant—i.e. the perceived degree of importance of ensuring contractors have access to relevant parts of the construction phase plan (Regulation 22(1)(h)) with the discharge of:

- ensuring construction phase is planned and monitored (Regulation 22(1)(a)) (r = .327, p = .003, n = 67, significant at the level 0.01);
- liaising with the CDM-C (Regulation 22(1)(b)) (r = .315, p = .003, n = 67, significant at the level 0.01);
- ensuring contractors have access to relevant parts of the construction phase plan (Regulation 22(1)(h)) (r = .340, p = .001, n = 67, significant at the level 0.01);
- ensuring contractors are given sufficient time before commencement of construction work (Regulation 22(1)(i)) (r = .330, p = .002, n = 67, significant at the level 0.01); and
- facilitating cooperation with workers (Regulation 24(a)) (r = .316, p = .004, n = 67, significant at the level 0.01).

The five pairs of associations alluded to above are highly significant given that the p-value is less than 0.01; thus, the conclusion reached is that these findings are strongly significant and reliable statistically speaking. Generally, it can be inferred that the majority of the duties placed on the PC, show positive associations between the extent of discharge and the perceived degree of importance as confirmed by earlier results (see Section 7.7.2). However, it was observed that the majority of the correlations are weak in strength. Which indicates that more awareness is needed regarding the importance of particular duties; as such, training is critical.

7.8.2.2 Correlation between extent of discharge of duties and perceived degree of difficulty

An inspection of the correlation matrix shows 119 statistically significant relationships of a negative strength (see Table 7.27). This means that the extent of discharge is associated with the ease with which the duty can be discharged. The results reveal that, only one of these is a strong relationship, while 23 of 119 (19%) were of a moderate association. The remaining 96 (81%) are of a weak association. However, even though the majority of the relationships are weak in strength, the trend of the correlation in terms of the decrease in the perceived degree of difficulty is consistent. Despite observing this weak strength in the correlation, they are not to be ignored. Myers and Well (2003) explain that in some instances, a weak strength may be of significance. As such, it is reasonable to conclude that the perceived degree of difficulty does not impede the discharge of PC duties (see also Section 7.7.2).

Indeed, it can be observed from the same correlation matrix that as the perceived degree of difficulty of facilitating cooperation with workers (Regulation 24(a)) reduces, there is a statistically significant increase in discharge of six duties. This outcome, invites further scrutiny into the resourcing requirements to perform these roles as discussed in Section 7.9.

Table 7.26: Correlation matrix: extent of discharge of duties and perceived degree of importance (PC)

Extent of discharge of duties

Perceived degree of importance		23(1)(a)	23(1)(c)	23(1)(b)	23(2)	22(1)(a)	22(1)(b)	22(1)(c)	22(1)(d)	22(1)(e)	22(1)(f)	22(1)(g)	22(1)(h)	22(1)(i)	22(1)(j)	22(1)(k)	22(1)(l)	22(2)	24(a)	24(b)	24(c)
23(1)(a)	*Correlation Coefficient*	-.046	.005	.039	.020	.157	.004	.090	-.016	-.076	-.042	-.005	-.013	-.019	-.166	-.092	-.030	-.095	-.087	-.176	-.009
	Sig. (2-tailed)	.683	.965	.725	.858	.170	.973	.432	.889	.501	.703	.967	.906	.866	.132	.394	.795	.411	.434	.111	.935
	N	67	67	67	66	67	67	67	66	67	67	67	67	66	67	66	67	67	67	67	67
23(1)(c)	*Correlation Coefficient*	.029	.004	.083	.141	.179	-.162	.020	-.005	.048	-.051	.057	.089	-.006	-.036	.024	.144	-.022	-.117	-.141	.044
	Sig. (2-tailed)	.803	.976	.462	.231	.131	.151	.864	.966	.679	.658	.618	.434	.956	.750	.834	.224	.857	.311	.215	.691
	N	67	67	67	66	67	67	67	66	67	67	67	67	66	67	66	67	67	67	67	67
23(1)(b)	*Correlation Coefficient*	-.004	-.075	.227*	.122	.270*	.057	.055	.099	.091	.037	.169	.203	.113	-.033	-.043	.072	.043	-.085	.107	-.013
	Sig. (2-tailed)	.968	.502	.033	.271	.015	.591	.618	.372	.409	.729	.116	.057	.292	.756	.686	.515	.705	.432	.317	.905
	N	67	67	67	66	67	67	67	66	67	67	67	67	66	67	66	67	67	67	67	67
23(2)	*Correlation Coefficient*	.225*	.217	.286**	.371**	.457**	.055	.147	.277*	.063	.059	.142	.246*	.066	-.044	.152	.106	.117	.030	.064	.081
	Sig. (2-tailed)	.046	.059	.009	.001	.000	.611	.198	.015	.579	.596	.197	.025	.553	.686	.162	.355	.313	.788	.561	.450
	N	67	67	67	66	67	67	67	66	67	67	67	67	66	67	66	67	67	67	67	67
22(1)(a)	*Correlation Coefficient*	.194	.164	.155	.377**	.391**	.122	.227*	.196	.226*	.159	.191	.327**	.233*	-.004	.072	.154	.201	.026	.014	.065
	Sig. (2-tailed)	.088	.155	.158	.001	.001	.265	.048	.087	.047	.152	.085	.003	.036	.969	.510	.178	.085	.818	.897	.549
	N	67	67	67	66	67	67	67	66	67	67	67	67	66	67	66	67	67	67	67	67
22(1)(b)	*Correlation Coefficient*	.091	.040	.211*	.124	.008	.293**	.004	.086	.199	.030	.044	.315**	.246*	.261*	.081	.131	.044	.060	.132	.249*
	Sig. (2-tailed)	.407	.719	.047	.263	.942	.006	.972	.438	.069	.781	.683	.003	.022	.015	.440	.236	.695	.581	.217	.017
	N	67	67	67	66	67	67	67	66	67	67	67	67	66	67	66	67	67	67	67	67
22(1)(c)	*Correlation Coefficient*	0.000	.194	.223*	.310**	.386**	.130	.215	.101	.060	.014	.126	.252*	.213	.265*	.090	.161	.325**	.238*	.118	.111
	Sig. (2-tailed)	1.000	.101	.047	.008	.001	.247	.066	.388	.607	.899	.265	.026	.062	.019	.420	.171	.006	.038	.298	.318
	N	67	67	67	66	67	67	67	66	67	67	67	67	66	67	66	67	67	67	67	67
22(1)(d)	*Correlation Coefficient*	-.213	-.035	-.009	-.021	.125	.099	.040	.062	-.016	-.030	.028	.006	-.019	.140	-.058	.110	.270*	.137	.022	-.051
	Sig. (2-tailed)	.067	.765	.935	.857	.288	.378	.735	.596	.892	.795	.807	.955	.869	.215	.602	.351	.023	.232	.844	.643
	N	67	67	67	66	67	67	67	66	67	67	67	67	66	67	66	67	67	67	67	67
22(1)(e)	*Correlation Coefficient*	.092	.064	.005	.048	.068	.133	.302**	.267*	.103	.162	.048	.193	.151	.151	.158	.129	.264*	.227*	.154	.105
	Sig. (2-tailed)	.419	.582	.964	.675	.552	.226	.008	.019	.364	.146	.663	.080	.174	.173	.148	.259	.023	.043	.164	.333
	N	67	67	67	66	67	67	67	66	67	67	67	67	66	67	66	67	67	67	67	67
22(1)(f)	*Correlation Coefficient*	.209	.174	.068	.102	.059	.107	.062	.187	.109	.140	.139	.140	.016	.164	.189	.231*	.191	.207	.048	.039
	Sig. (2-tailed)	.054	.116	.517	.350	.590	.307	.573	.087	.314	.188	.190	.185	.878	.121	.070	.035	.087	.053	.649	.705
	N	67	67	67	66	67	67	67	66	67	67	67	67	66	67	66	67	67	67	67	67
22(1)(g)	*Correlation Coefficient*	.197	.184	.168	.171	.157	.040	-.022	.177	.191	.242*	.362**	.232*	.074	.136	.155	.238*	.148	.135	.043	.116
	Sig. (2-tailed)	.069	.098	.111	.119	.154	.706	.842	.108	.079	.023	.001	.028	.491	.201	.140	.030	.184	.210	.683	.266
	N	66	66	66	65	66	66	66	65	66	66	66	66	65	66	65	66	66	66	66	66
22(1)(h)	*Correlation Coefficient*	.223*	.121	.286**	.240*	.086	.123	-.019	.196	.213*	-.027	.125	.340**	.157	.190	.021	.156	.168	.069	.206	.182
	Sig. (2-tailed)	.039	.272	.006	.028	.432	.240	.862	.073	.049	.796	.237	.001	.139	.072	.837	.155	.130	.521	.052	.078
	N	67	67	67	66	67	67	67	66	67	67	67	67	66	67	66	67	67	67	67	67
22(1)(i)	*Correlation Coefficient*	.271*	.247*	.171	.199	.145	.132	.077	.266*	.192	.168	.249*	.330**	.199	.248*	.160	.235*	.202	.180	.137	.193
	Sig. (2-tailed)	.012	.025	.104	.068	.188	.206	.483	.015	.076	.112	.019	.002	.060	.019	.125	.032	.069	.092	.196	.062

Extent of discharge of duties

Perceived degree of importance		**23(1)(a)**	**23(1)(c)**	**23(1)(b)**	**23(2)**	**22(1)(a)**	**22(1)(b)**	**22(1)(c)**	**22(1)(d)**	**22(1)(e)**	**22(1)(f)**	**22(1)(g)**	**22(1)(h)**	**22(1)(i)**	**22(1)(j)**	**22(1)(k)**	**22(1)(l)**	**22(2)**	**24(a)**	**24(b)**	**24(c)**
	N	67	67	67	66	67	67	67	66	67	67	67	67	66	67	66	67	67	67	67	67
22(1)(j)	*Correlation Coefficient*	.136	.043	.143	.147	.155	.060	.034	.099	.138	.124	.176	.258*	.207	.247*	.194	.132	.104	.058	-.020	.204
	Sig. (2-tailed)	.217	.700	.179	.184	.165	.571	.757	.370	.211	.251	.101	.016	.055	.021	.067	.236	.357	.596	.854	.052
	N	67	67	67	66	67	67	67	66	67	67	67	67	66	67	66	67	67	67	67	67
22(1)(k)	*Correlation Coefficient*	-.085	-.096	-.015	-.024	.012	0.000	.090	.053	.075	-.066	.047	.119	.144	-.010	.039	.056	.058	.109	.070	.120
	Sig. (2-tailed)	.455	.409	.889	.836	.917	1.000	.431	.641	.506	.555	.672	.281	.196	.929	.722	.623	.619	.331	.526	.269
	N	67	67	67	66	67	67	67	66	67	67	67	67	66	67	66	67	67	67	67	67
22(1)(l)	*Correlation Coefficient*	.058	.132	.005	.059	.114	-.001	.011	-.015	-.092	-.029	0.000	.048	.056	-.156	-.065	.059	.088	.033	-.068	-.110
	Sig. (2-tailed)	.612	.260	.962	.609	.327	.995	.924	.898	.424	.796	1.000	.668	.618	.163	.556	.609	.453	.768	.544	.317
	N	67	67	67	66	67	67	67	66	67	67	67	67	66	67	66	67	67	67	67	67
22(2)	*Correlation Coefficient*	-.166	-.058	-.113	-.113	.069	-.110	.058	-.071	-.110	-.018	-.032	-.008	-.074	.004	.006	-.004	.130	.200	.034	-.019
	Sig. (2-tailed)	.151	.624	.314	.330	.557	.322	.618	.541	.343	.870	.777	.947	.513	.970	.958	.975	.272	.079	.764	.861
	N	67	67	67	66	67	67	67	66	67	67	67	67	66	67	66	67	67	67	67	67
24(a)	*Correlation Coefficient*	.238*	.234*	.207	.134	.115	.096	.149	.261*	.119	.143	.243*	.316**	.202	.109	.282**	.100	.213	.260*	.261*	.269*
	Sig. (2-tailed)	.033	.040	.056	.233	.310	.374	.187	.021	.286	.191	.026	.004	.067	.319	.009	.377	.064	.018	.017	.012
	N	67	67	67	66	67	67	67	66	67	67	67	67	66	67	66	67	67	67	67	67
24(b)	*Correlation Coefficient*	.141	.137	.148	.012	.171	.133	.146	.292**	.226*	.192	.302**	.254*	.167	.093	.214*	.217*	.319**	.362**	.295**	.276**
	Sig. (2-tailed)	.193	.217	.159	.910	.121	.206	.184	.008	.038	.071	.005	.016	.118	.383	.041	.048	.004	.001	.006	.008
	N	67	67	67	66	67	67	67	66	67	67	67	67	66	67	66	67	67	67	67	67
24(c)	*Correlation Coefficient*	.078	-.024	.075	.004	-.032	-.036	-.121	.043	.201	.032	.101	.155	.053	.170	.185	.109	.034	.047	.070	.301**
	Sig. (2-tailed)	.465	.826	.474	.972	.767	.726	.265	.690	.062	.761	.337	.139	.612	.105	.074	.317	.759	.658	.506	.003
	N	67	67	67	66	67	67	67	66	67	67	67	67	66	67	66	67	67	67	67	67

(Refer to Section 4.4.1.5 for the description of duties of the PC, *significant at 0.05 level, **significant at the 0.01 level, green: positive correlation, red: negative correlation)

Table 7.27: Correlation matrix: extent of discharge of duties and perceived degree of difficulty (PC)

Extent of discharge of duties

Perceived degree of difficulty		23(1)(a)	23(1)(c)	23(1)(b)	23(2)	22(1)(a)	22(1)(b)	22(1)(c)	22(1)(d)	22(1)(e)	22(1)(f)	22(1)(g)	22(1)(h)	22(1)(i)	22(1)(j)	22(1)(k)	22(1)(l)	22(2)	24(a)	24(b)	24(c)
23(1)(a)	*Correlation Coefficient*	-.209	**-.308****	**-.266***	**-.270***	-.206	-.172	-.141	**-.231***	-.168	-.110	-.198	**-.254***	**-.261***	.046	**-.239***	**-.260***	-.091	-.179	-.093	-.060
	Sig. (2-tailed)	.054	.005	.015	.014	.057	.116	.205	.041	.130	.324	.070	.019	.016	.670	.034	.020	.401	.100	.393	.582
	N	66	66	66	66	66	65	66	66	65	66	66	66	66	66	66	66	66	66	66	65
23(1)(c)	*Correlation Coefficient*	.002	-.089	-.137	-.002	-.008	-.069	-.221	-.052	-.075	-.034	-.179	-.187	-.153	-.035	-.188	-.070	-.017	-.077	-.047	-.149
	Sig. (2-tailed)	.987	.431	.222	.987	.943	.542	.055	.656	.510	.768	.113	.096	.172	.753	.107	.543	.881	.493	.675	.186
	N	66	66	66	66	66	65	66	66	65	66	66	66	66	66	66	66	66	66	66	65
23(1)(b)	*Correlation Coefficient*	-.150	-.056	**-.259***	-.102	-.005	-.055	-.050	-.103	**-.287****	-.095	**-.248***	**-.222***	-.146	-.023	-.144	-.172	-.170	**-.271***	**-.221***	-.189
	Sig. (2-tailed)	.153	.598	.014	.336	.961	.606	.644	.348	.008	.381	.019	.035	.166	.827	.187	.111	.107	.010	.037	.076
	N	66	66	66	66	66	65	66	66	65	66	66	66	66	66	66	66	66	66	66	65
23(2)	*Correlation Coefficient*	-.093	-.086	-.199	**-.229***	-.037	-.047	-.193	-.082	-.193	**-.241***	**-.285****	**-.235***	-.185	-.021	-.214	-.192	**-.215***	**-.313****	-.200	-.172
	Sig. (2-tailed)	.387	.430	.067	.035	.734	.667	.083	.470	.081	.030	.009	.030	.087	.848	.057	.084	.047	.004	.065	.116
	N	66	66	66	66	66	65	66	66	65	66	66	66	66	66	66	66	66	66	66	65
22(1)(a)	*Correlation Coefficient*	-.054	**-.228***	**-.241***	-.179	-.137	-.135	-.119	-.118	**-.320****	**-.225***	**-.260***	**-.314****	**-.268***	.062	-.128	-.174	-.137	**-.311****	**-.221***	-.200
	Sig. (2-tailed)	.617	.038	.027	.102	.208	.218	.288	.299	.004	.045	.018	.004	.014	.565	.256	.119	.206	.004	.043	.068
	N	66	66	66	66	66	65	66	66	65	66	66	66	66	66	66	66	66	66	66	65
22(1)(b)	*Correlation Coefficient*	-.168	-.167	-.163	-.178	**-.228***	**-.274****	-.048	-.158	**-.239***	-.013	-.102	-.155	**-.277****	-.174	-.138	-.085	-.001	-.179	-.076	-.038
	Sig. (2-tailed)	.108	.114	.121	.092	.030	.010	.659	.150	.026	.904	.336	.138	.008	.095	.204	.430	.990	.090	.468	.718
	N	66	66	66	66	66	65	66	66	65	66	66	66	66	66	66	66	66	66	66	65
22(1)(c)	*Correlation Coefficient*	-.022	-.177	-.184	-.157	-.052	-.003	-.174	-.057	-.045	-.034	.009	-.022	-.080	.125	-.128	.050	.025	-.096	-.031	-.019
	Sig. (2-tailed)	.844	.116	.099	.162	.641	.981	.129	.626	.691	.769	.937	.844	.474	.257	.269	.662	.819	.391	.782	.866
	N	66	66	66	66	66	65	66	66	65	66	66	66	66	66	66	66	66	66	66	65
22(1)(d)	*Correlation Coefficient*	-.016	-.091	-.171	.042	.064	.078	.038	.013	-.036	.137	-.119	-.101	-.105	.086	-.047	.093	.012	-.140	-.061	-.078
	Sig. (2-tailed)	.888	.416	.126	.706	.566	.488	.742	.908	.752	.231	.291	.365	.344	.436	.687	.418	.914	.210	.583	.487
	N	66	66	66	66	66	65	66	66	65	66	66	66	66	66	66	66	66	66	66	65
22(1)(e)	*Correlation Coefficient*	-.103	**-.234***	-.184	**-.261***	**-.259***	-.106	-.197	-.157	**-.342****	**-.274***	**-.278***	**-.363****	**-.244***	-.077	**-.259***	**-.251***	**-.226***	**-.422****	**-.356****	-.111
	Sig. (2-tailed)	.341	.032	.091	.017	.017	.333	.078	.167	.002	.014	.011	.001	.025	.475	.022	.025	.038	.000	.001	.314
	N	66	66	66	66	66	65	66	66	65	66	66	66	66	66	66	66	66	66	66	65
22(1)(f)	*Correlation Coefficient*	-.029	-.146	-.182	**-.218***	**-.227***	**-.254***	-.068	-.116	**-.248***	**-.263***	**-.238***	-.166	**-.251***	-.188	-.042	-.110	-.074	**-.257***	-.161	-.055
	Sig. (2-tailed)	.782	.163	.081	.037	.029	.016	.527	.285	.019	.014	.023	.110	.016	.069	.699	.306	.475	.014	.124	.600

Extent of discharge of duties

Perceived degree of difficulty		23(1)(a)	23(1)(c)	23(1)(b)	23(2)	22(1)(a)	22(1)(b)	22(1)(c)	22(1)(d)	22(1)(e)	22(1)(f)	22(1)(g)	22(1)(h)	22(1)(i)	22(1)(j)	22(1)(k)	22(1)(l)	22(2)	24(a)	24(b)	24(c)
	N	66	66	66	66	66	65	66	66	65	66	66	66	66	66	66	66	66	66	66	65
22(1)(g)	*Correlation Coefficient*	-.003	-.141	-.212*	-.151	-.180	-.301**	-.107	-.107	-.232*	-.260*	-.306**	-.172	-.237*	-.250*	.115	-.040	-.096	-.189	-.192	-.105
	Sig. (2-tailed)	.976	.179	.043	.152	.084	.004	.320	.327	.029	.016	.004	.099	.023	.016	.288	.710	.359	.071	.067	.321
	N	65	65	65	65	65	64	65	65	64	65	65	65	65	65	65	65	65	65	65	64
22(1)(h)	*Correlation Coefficient*	.015	.010	-.125	-.066	-.089	-.117	-.093	-.116	-.263*	-.137	-.227*	-.230*	-.284**	-.201	-.007	-.145	-.235*	-.345**	-.321**	-.248*
	Sig. (2-tailed)	.885	.928	.230	.529	.393	.263	.385	.286	.013	.200	.030	.027	.006	.052	.950	.175	.024	.001	.002	.018
	N	66	66	66	66	66	65	66	66	65	66	66	66	66	66	66	66	66	66	66	65
22(1)(i)	*Correlation Coefficient*	.073	-.118	-.157	-.111	-.167	-.271**	-.102	-.060	-.213*	-.188	-.214*	-.249*	-.354**	-.196	.051	-.098	-.093	-.317**	-.289**	-.072
	Sig. (2-tailed)	.482	.260	.133	.287	.108	.010	.339	.578	.045	.079	.041	.016	.001	.057	.640	.358	.371	.002	.005	.494
	N	66	66	66	66	66	65	66	66	65	66	66	66	66	66	66	66	66	66	66	65
22(1)(j)	*Correlation Coefficient*	-.048	-.216*	-.197	-.172	-.155	-.082	-.184	-.026	-.226*	-.259*	-.232*	-.306**	-.308**	-.261*	-.135	.003	-.030	-.292**	-.190	-.068
	Sig. (2-tailed)	.648	.043	.063	.106	.141	.439	.090	.816	.036	.017	.029	.004	.003	.013	.217	.980	.775	.006	.073	.521
	N	66	66	66	66	66	65	66	66	65	66	66	66	66	66	66	66	66	66	66	65
22(1)(k)	*Correlation Coefficient*	-.073	-.011	-.048	-.052	-.025	.197	-.053	-.023	-.025	.075	-.009	-.084	-.196	.005	-.378**	.031	-.043	-.159	-.160	.088
	Sig. (2-tailed)	.504	.922	.662	.639	.816	.074	.634	.842	.825	.503	.934	.440	.072	.964	.001	.782	.696	.148	.143	.426
	N	66	66	66	66	66	65	66	66	65	66	66	66	66	66	66	66	66	66	66	65
22(1)(l)	*Correlation Coefficient*	-.112	-.094	-.113	-.090	-.137	-.038	.005	-.109	-.076	-.041	.032	-.104	-.140	.091	-.197	-.202	-.197	-.216	-.227*	-.070
	Sig. (2-tailed)	.311	.401	.309	.417	.214	.736	.966	.344	.504	.721	.776	.349	.203	.410	.087	.076	.076	.052	.041	.531
	N	66	66	66	66	66	65	66	66	65	66	66	66	66	66	66	66	66	66	66	65
22(2)	*Correlation Coefficient*	-.072	-.184	-.240*	-.127	-.180	.024	-.072	-.073	-.227*	-.100	-.269*	-.265*	-.136	-.103	-.255*	-.067	-.238*	-.258*	-.274*	-.124
	Sig. (2-tailed)	.517	.099	.031	.255	.103	.831	.525	.526	.045	.382	.016	.017	.220	.351	.027	.557	.032	.020	.014	.268
	N	66	66	66	66	66	65	66	66	65	66	66	66	66	66	66	66	66	66	66	65
24(a)	*Correlation Coefficient*	-.136	-.250*	-.314**	-.274*	-.243*	-.124	-.148	-.072	-.289**	-.244*	-.281**	-.251*	-.209	-.219*	-.110	-.235*	-.213*	-.368**	-.465**	-.132
	Sig. (2-tailed)	.206	.021	.004	.011	.024	.255	.179	.523	.008	.028	.010	.019	.051	.040	.325	.033	.048	.001	.000	.222
	N	66	66	66	66	66	65	66	66	65	66	66	66	66	66	66	66	66	66	66	65
24(b)	*Correlation Coefficient*	-.162	-.161	-.335**	-.223*	-.274**	-.179	.003	-.038	-.315**	-.169	-.285**	-.247*	-.269**	-.187	-.093	-.213*	-.293**	-.404**	-.529**	-.142
	Sig. (2-tailed)	.118	.124	.001	.033	.008	.089	.975	.725	.003	.115	.007	.018	.010	.071	.390	.047	.005	.000	.000	.176
	N	66	66	66	66	66	65	66	66	65	66	66	66	66	66	66	66	66	66	66	65
24(c)	*Correlation Coefficient*	-.146	-.055	-.085	-.006	.013	-.033	.054	.011	.010	-.047	-.189	-.100	-.079	-.121	.055	.027	-.025	-.134	-.134	-.257*

Perceived degree of difficulty		**23(1)(a)**	**23(1)(c)**	**23(1)(b)**	**23(2)**	**22(1)(a)**	**22(1)(b)**	**22(1)(c)**	**22(1)(d)**	**22(1)(e)**	**22(1)(f)**	**22(1)(g)**	**22(1)(h)**	**22(1)(i)**	**22(1)(j)**	**22(1)(k)**	**22(1)(l)**	**22(2)**	**24(a)**	**24(b)**	**24(c)**
	Sig. (2-tailed)	.156	.596	.411	.957	.900	.748	.610	.919	.921	.656	.068	.333	.441	.238	.610	.797	.807	.195	.195	.014
	N	66	66	66	66	66	65	66	66	65	66	66	66	66	66	66	66	66	66	66	65

(Refer to Section 4.1.1.5 for the description of duties of the PC, *significant at 0.05 level, **significant at the 0.01 level, green: positive correlation, red: negative correlation)

7.9 RESOURCING REQUIREMENTS TO PERFORM ROLES OF THE CDM-C AND PC: FINDINGS AND DISCUSSION

The resourcing required for adequately discharging the function(s) of a CDM-C and the PC is crucial. Once appointed, it is mandatory for these two duty holders to remain on the project up to completion (see Regulation 14(3)). It is against this background that resourcing requirements to perform either role are critically analysed.

By analysing the resource requirements to perform their roles, it clearly emerges that resourcing largely depends on the project type and scope because of differing risk considerations as indicated and confirmed by both CDM-Cs and PCs. Sections 7.9.1 and 7.9.2 scrutinises the results in detail.

7.9.1 Resourcing required to perform the role of CDM-C

The role of the CDM-C in compliance of the CDM Regulations is critical given that they have the responsibility to advise and assist the Client (Regulation 20(1)(a)) (see Figure 4.6). It is therefore unsurprising that adequate resourcing to perform the role is critical. The importance of adequate resourcing to perform the role of the CDM-C has been demonstrated in several studies undertaken previously (e.g. Scopes, 2009a,b; Shiplee *et al.*, 2011). However, the resourcing required to properly perform this role and adhere to the legal obligations remain largely unknown. Given this background, respondents provided information relating to adequacy of resourcing based on a 5-point likert scale. The rating was as follows: i.e. — 5 = *always,* 4 = *often,* 3 = *sometimes,* 2 = *rarely,* 1 = *never.*

Secondly, they indicated the resourcing requirements during the preconstruction planning phase and the construction phase using time as a proxy. This chronological order reflects the ethos of coordination as specified in the TMCS Directive where two coordination phases are clearly established (i.e. preconstruction and the construction phase).

Adequate resourcing not only benefits the duty holder, but also the Client, given their reliance on the expertise of the CDM-C (Regulation 20(1)(a)). The ACoP clearly establishes this reliance and explains that:

> *The CDM Coordinator provides clients with a key project adviser in respect of construction health and safety risk management matters. Their main purpose is to help clients carry out their duties; to coordinate health and safety aspects of the design work and prepare the health and safety file* [Paragraph 84].

Resourcing in the context of this research refers to competence requirements relative to the inherent risk of a project, arguably dependant on its size and complexity. More specifically, it includes skilled and competent teams/workforces required to discharge duty holder functions, during the preconstruction phase and construction phase.

Take for example, identifying, collecting and providing preconstruction information (Regulation 20(2)(a) and 20(2)(b)), which is discharged in tandem with the Client's responsibility to provide preconstruction information to Designers and Contractors (Regulation 10(2)). Failure to adequately resource this activity, sets the foundations for ineffective discharge of duties, thus undermining H&S management on projects. Also, despite several reports suggesting the inadequate resourcing of the CDM-C role because of lack of meaningful collaboration (e.g. SEC, 2010; ICE 2011), no insight is provided regarding the actual resourcing required in terms of 'man-days'.

To perform the role of the CDM-C, the results presented in Table 7.28 show that, cumulatively, 68.1% of the respondents were adequately resourced compared to 32% who were not. It is surprising that 32% of the CDM-Cs were not adequately resourced on projects they coordinate. Further, the evidence suggests that typically not more than 20 'man-days' were required during preconstruction, and not more than two man-days per week during the construction phase (approximately 67% of the respondents, see Table 7.29). At a median cost of £301 - 400 per man-day (see Figure 7.7), this evidence equates to between £6020 - £8000 at preconstruction phase, and £602 - £800 per week (or approximately £22,000 - £29,000 for a typical 9-month project) during the construction phase. Compared to the cost of an accident which is estimated at a minimum of £60,000 (e.g. Ikpe *et al.*, 2011), this represents a reasonable investment towards improved H&S outcomes. Given the preceding observation, it is unsurprising that in practice few respondents appointed in the role of CDM-C undertake combined responsibilities, as depicted in Table 7.28. Typically, the combined role of CDM-C and Contract Administrator was the most common (26%).

Table 7.28: Resourcing requirements to perform the role of CDM-C and tendency to take on combined roles

Role(s) undertaken	**1-never**, *n* (%)	**2-rarely**, *n* (%)	**3-sometimes**, *n* (%)	**Cumulative**, *n* (%)	**4-often**, *n* (%)	**5-always**, *n* (%)	**Cumulative**, *n* (%)	**Median**	**Mean**	**R.I.**
Adequacy of resourcing to perform the role of CDM-C	1 (2.1)	6 (12.5)	8 (17)	15 (31.6)	18 (38.3)	14 (29.8)	32 (68.1)	4.00	3.81	76.2
CDM-C and Contract Administrator	22 (46.8)	2 (4.3)	11 (23.4)	35 (74.5)	10 (21.3)	2 (4.3)	12 (25.6)	2.00	2.32	46.4
CDM-C and Designer	23 (48.9)	4 (8.5)	10 (21.3)	37 (78.7)	7 (14.9)	3 (6.4)	10 (21.3)	2.00	2.21	44.2
CDM-C and PC	39 (83)	5 (10.6)	2 (4.3)	46 (97.9)	0 (0)	1 (2.2)	1 (2.2)	1.00	1.28	25.6
CDM-C and Main Contractor	41 (87.2)	2 (4.3)	3 (6.4)	46(97.9)	0 (0)	1 (2.2)	1 (2.2)	1.00	1.26	25.2
CDM-C and Client	42 (91.3)	1 (2.2)	1 (2.2)	43(95.7)	1 (2.2)	1 (2.2)	2 (4.3)	1.00	1.22	24.4

Table 7.29: Man-days required to perform the role of CDM-C

Preconstruction phase	**Respondents (%)**	**Construction phase**	**Respondents (%)**
Less than 10 man days	22 (45.8)	Less than 1 man day per week	27 (56.2)
11 – 20 man days	10 (20.8)	2 man days per week	5 (10.4)
21 – 30 man days	0 (0)	3 man days per week	0 (0)
31- 40 man days	1 (2.1)	4 man days per week	0 (0)
41 – 50 man days	0 (0)	5 man days per week	0 (0)
Depends on project size and complexity	14 (29.2)	Depends on project size and complexity	15 (31.2)
Unspecified	1 (2.1)	Unspecified	1 (2.1)
Mode (less than 10 man days)		*Mode (less than 1 man day per week)*	
Median (11 – 20 man days)		*Median (less than 1 man day per week)*	

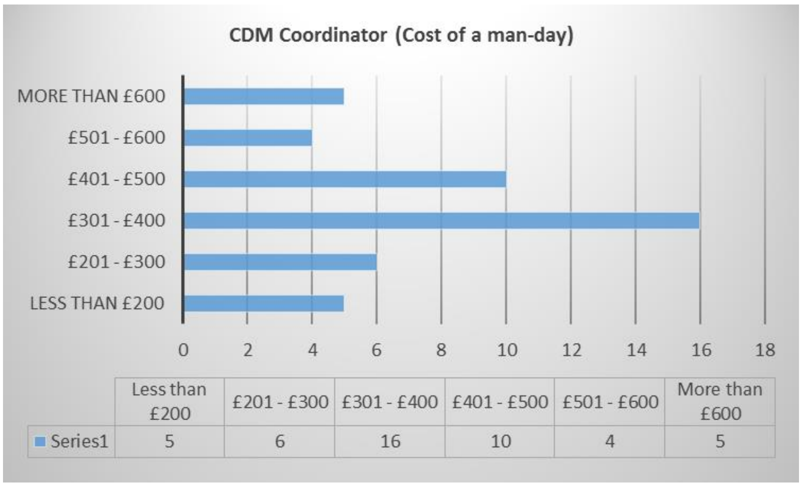

Figure 7.7: Cost of a 'man-day' (CDM-C)

7.9.2 Resourcing required to perform the role of PC

The results shown in Table 7.30 indicate that the resourcing to perform the role of the PC is inadequate, according to at least 31% of the respondents. Considering the 'man-day' resourcing requirements, the results show that during the preconstruction stage, not more than 20 'man-days' were required. Whereas during the construction phase, the resourcing required was not more than five man-days per week (see Table 7.31). Similar to the CDM-C, the median cost is £301 - £400 per man-day (see Figure 7.8). This equates to between £6020 - 8000 at preconstruction phase, or £1505 - £2000 per week (approximately £54,500 - £72,000 for a typical 9-month project) during the construction phase. Arguably, this largely depends on the project size among other features as emphasised by PC Respondent 20 in relation to pre-construction phase requirements:

> *often we utilise more than 50 man-days due to the size of the projects we undertake. Our smallest project is £20 million but most are £100 million plus, with one at £700 million.*

Table 7.30: Resourcing requirements to perform the role of PC and tendency to take on combined roles

Description of CDM duty holder role(s) undertaken	1-never, *n* (%)	2-rarely, *n* (%)	3-sometimes, *n* (%)	Cumulative, *n* (%)	4-often, *n* (%)	5-always, *n* (%)	Cumulative, *n* (%)	Median	Mean	R.I.
I am usually provided with enough resources to perform my role as PC	0 (0)	4 (6)	17 (25.4)	21 (31.4)	25 (37.3)	18 (26.9)	43 (64.2)	4.00	3.88	77.6
I (or my organisation) take/s on the combined roles of PC and Main Contractor	8 (11.9)	3 (4.5)	13 (19.4)	24 (35.8)	26 (38.8)	15 (22.4)	41 (61.2)	4.00	3.54	70.8
I (or my organisation) take/s on the combined roles of PC and Designer	20 (29.9)	10 (14.9)	20 (29.9)	40 (74.7)	14 (20.9)	1 (1.5)	15 (22.4)	3.00	2.48	49.6
I (or my organisation) take/s on the combined roles of PC and Client	29 (43.3)	13 (19.4)	14 (20.9)	56 (83.6)	7 (10.4)	2 (3)	9 (14.4)	2.00	2.08	41.6
I (or my organisation) take/s on the combined roles of PC and Contractor Administrator	30 (44.8)	14 (20.9)	11 (16.4)	55 (82.1)	8 (11.9)	2 (3)	10 (14.9)	2.00	2.05	41.0
I (or my organisation) take/s on the combined roles of PC and CDM-C	28 (41.8)	16 (23.9)	16 (23.9)	60 (89.6)	5 (7.5)	0 (0)	5 (7.5)	2.00	1.97	39.4

Table 7.31: Man days required to perform the role of the PC

Preconstruction	Respondents (%)	Construction phase	Respondents (%)
Less than 10 man days	14 (20.9)	Less than 1 man day per week	11 (16.4)
11 – 20 man days	23 (34.3)	2 man days per week	10 (14.9)
21 – 30 man days	8 (11.9)	3 man days per week	6 (9)
31- 40 man days	5 (7.5)	4 man days per week	2 (3)
41 – 50 man days	4 (6)	5 man days per week	21 (31.3)
Depends on project size and complexity	11 (16.4)	Depends on project size and complexity	15 (22.4)
Unspecified	2 (3)	Unspecified	2 (3)
Mode (11 – 20 man days)		*Mode (5 man days per week)*	
Median (11 – 20 man days)		*Median (5 man days per week)*	

Table 7.32: Evidence of competence (PC)

Evidence of competence	Median	Mean	Std. Dev.	R.I.
Past experience	5.00	4.36	.939	87.2
Organisation profile	5.00	4.35	.959	87
Knowledge/expertise	4.00	4.18	.998	83.6
Certification	4.00	4.08	.989	81.6
Individual qualification	4.00	3.80	1.126	76
Professional institution membership	3.00	3.23	1.222	64.6
Continuous professional development	3.00	2.98	1.244	59.6

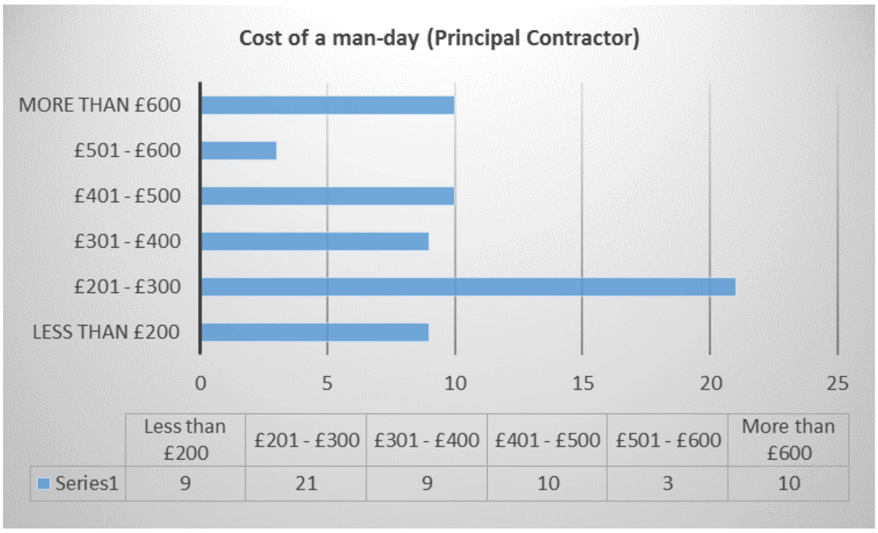

Figure 7.8: Cost of a 'man-day' (PC)

Further, considering the central tendency scores in Table 7.30, it can be observed that typically the PC is the Main Contractor (61%). On the other hand, it was rare for them to take on the role of Client, Contract Administrator, and CDM-C.

When considering the adequacy of resources of the PC, the Client is also likely to consider past performance and various other forms of evidence. It is against such a background that PCs were requested to confirm the evidence provided as proof of their competence (Regulation 4). It is shown that past performance is considered as the most important factor followed by the organisation's profile (see Table 7.32); as such, consistent with the provisions of the ACoP (see paragraphs 195-198).

Other views clearly emphasising that resourcing requirements hinged on varied project features were expressed in the following manner:

> *Subject to project size and if D+ B* [PC Respondent 1]

> *…varies according to project risks, size, scope of work, stakeholders, and complexity of work. Also depends on early appointment of* PC [PC Respondent 3].
> *Really depends on scope of project and the team surrounding/assisting* [PC Respondent 14]

> *It depends on the quality of the preconstruction information provided and the time taken by the CDMC to review the construction phase plan* [PC Respondent 15]

> *It is a continual process throughout the programme of works. Therefore, the above is dependent upon the duration of the contract* [Respondent 24]

> *Depends on project value and size also specific risks of project* [PC Respondent 25]

> *...depends on size of job. However this is not a stand-alone role and falls into the site team's duties* [Respondent 26]

> *Dependent on the site and complexity of the project. On a complex, multimillion-pound new build, preconstruction planning can include a large number of people and take several months* [PC Respondent 27]

> *3 man team approximately 2/3 weeks carrying out various tasks – does not include QS roles* [PC Respondent 37].

> *This varies massively; we execute projects from 500K – £500 million* [PC Respondent 64].

> *Does depend upon details of documentation provided by CDM-C* [PC Respondent 65].

It is however important to emphasise that regardless of these views, the results still provide credible insight into what is typical based on the experiences of some of the respondents.

7.10 CHAPTER SUMMARY

There is compelling evidence suggesting the existence of disparities in the extent of discharge of duties pertaining to the roles of the CDM-C and PC. The findings also suggest that the perceived degree of importance and difficulty does is largely misaligned with the extent of discharge of duties. Whereas, the empirical evidence also confirms that there are significant differences in the perceived degree of importance and difficulty of duties.

Whilst the perceived degree of difficulty of some duties does not typically impede their discharge, it is startling to note that the extent of discharge of some duties still varies. It can be observed from the results that there is a lack of understanding the criticality of duties; indicating that deployment of resources is often misaligned.

From the data analysis and discussion contained in Chapters 6 and 7, it is unequivocal that there are collaboration, compliance, and facilitation challenges regarding the practical implementation of the CDM Regulations. Thus, these three recurring themes inform the remedial action framework as elaborated in Section 8.5. A thorough discussion on the developed remedial action framework to improve CDM implementation is then provided. It begins by describing and contextualising the main themes emerging from the results, after which a discussion on the implications of the findings and the proposed remedial framework is presented.

CHAPTER 8: DEVELOPMENT OF THE REMEDIAL ACTION FRAMEWORK

8.0 INTRODUCTION

The remedial action framework to trigger improved CDM implementation is developed in this chapter, thus partially meeting the fifth objective of the study. The results discussed in Chapters 6 and 7, largely inform the developed framework comprising 13 remedial actions and 8 change drivers. The chapter first provides a brief discussion on the recurring themes emerging from the results. It then discusses the extent of transposition of the TMCS Directive and the proposed changes to the CDM 2007 as suggested by the research participants. Further, steps taken to develop the framework are described in detail.

8.1 KEY THEMES INFORMING THE REMEDIAL ACTION FRAMEWORK

Three recurring themes drawn from the research results, underpin the framework for improved implementation of the CDM Regulations. These are: (i) collaboration; (ii) accountability and compliance; and (iii) facilitation. Collaboration in this context refers to interdependent working of duty holders; while accountability and compliance, also drawn from the results, means that there is under-implementation of the CDM. As for facilitation, it is based on the premise that for successful CDM implementation, a conducive environment within the construction supply chain is critical.

Moreover, addressing H&S issues in a holistic manner as demonstrated by Bomel (2004) yields significant benefits (see Figure 2.4). As such, these themes adopt the shared responsibility ethos and wider perspective of the TMCS Directive and the HWSA 1974 that encourage proactive stakeholder collaboration. Such a view is also consistent with the recommendations made in a seminal report that describes best practices regarding information exchange amongst CDM duty holders in the context of the "wider construction industry" (Mulholland *et al.*, 2005). Indeed, improved H&S awareness on most construction projects is often triggered by accountability, management leadership and statutory compliance (see e.g. Evans, 2008; Scopes, 2009a,b; Shiplee *et al.*, 2011; Frontline Consultants, 2011; Webster, 2013). This finding is consistent with those reported by The Consultancy Company (1997), having evaluated the CDM 1994. It is therefore conceivable to suggest that project stakeholders mandated with various CDM obligations are suitable units of analysis for this study.

The first theme emanates from the empirical evidence, which shows that interdependent working is critical in order to remain compliant with the CDM Regulations. Besides, it is of no coincidence that the successful discharge of the majority of duties relies on the input received from other duty holders. For example, the perceived degree of importance of preconstruction information provision by the CDM-C (Regulation 20(2)(b)) is considered the most important duty and had the highest number of positive correlations with various other duties. Similarly, the PC duty to ensure site induction and training (Regulation 22(2)) is perceived most important. The perceived degree of importance of these duties demonstrates the criticality of stakeholder participation in adhering to the regulations.

Given such a background, it is therefore unsurprising that the effective discharge of some duties hinges on others. An example of such a duty that other duties hinge on is the provision of preconstruction. As long as this duty is not effectively discharged, the 'ripple effects' may be costly. Such information is required by the Designer to eliminate hazards and reduce risks (Regulation 11(4)), prepare the Construction Phase Plan (Regulation 23(1)(a)), while it is required by the CDM-C during preparation of the H&S File (Regulation 20(2)(e)). Further, it was also revealed that the duties that involve collaboration were the least discharged, contrary to requirements of the TMCS Directive (see Article 4). As such, key stakeholder involvement and collaboration is vitally important. Not only does it encourage compliance with the CDM Regulations, it also improves H&S management and its overall outlook. However, the results are indicative of the view that the perceived degree of difficulty generally did not impede the discharge of duties, which signals willingness of the stakeholders to get involved.

The second theme derived from the empirical evidence suggests a lack of accountability and compliance on the part of the duty holders. The results show that the majority of the duties pertaining to the role of the CDM-C and PC, and some duties of the Designer are not typically discharged regularly as required by the law. Perhaps, this is unsurprising given the numerous concerns surrounding the CDM 2007; particularly with the role of the CDM-C (e.g. SEC, 2010; ICE, 2011). At least 90% of the CDM-C's duties (9 of 10) were discharged irregularly, while 70% of the PC's duties (14 of 20) were not always discharged (see Section 7.4) going by the central tendency scores and the relative index analysis. This indicates a lack of accountability and compliance. Coupled with the infrequent discharge of duties, the findings indicate that over 30% of both duty holders are ill equipped in terms of resources to perform their role adequately.

The third theme is informed by the need to facilitate the process that targets improved CDM implementation and H&S management. The results revealed that 50% of the CDM-C duties are misaligned, whereas, 25% of the PC duties are also misaligned in terms of extent of discharge and their perceived degree of importance to influence H&S outcomes. This signals a lack of understanding of duties regarding their intended outcomes and invites the need for specific training targeting individual duties and duty holders rather than perhaps training of a generic manner. A study conducted by Anderson (2010) went as far as proposing a set of regulations to enhance construction H&S training at tertiary level and explained the specific roles of the stakeholders. Similarly, this study recommends amendments targeting specific duties and introduction of new provisions. Most importantly, to realign the regulations, a discussion is provided on the transposition of the TMCS Directive based on the implications of findings from the study.

8.2 TRANSPOSITION OF THE TMCS DIRECTIVE: DISCUSSION AND IMPLICATIONS OF THE FINDINGS

As a member state of the European Union (EU), the CDM Regulations transpose provisions of the TMCS Directive (see Chapter 4). This requirement invites further scrutiny of the results, comparing them with provisions of the TMCS Directive. In the first instance, the duties are arranged in accordance with the TMCS Directive, particularly taking cognizance of the following provisions: (i) appointment of coordinators, safety and health plan, prior notice (Article 3); (ii) project preparation stage general principles (Article 4); (iii) project preparation stage duties (Article 5); and (iv) project execution stage duties (Article 6). As such, it entails arranging the CDM duties of the CDM-C and PC in two stages—i.e. project preparation and execution to depict the format of the TMCS Directive (see Tables 8.1 and 8.2). Therefore, this offers the ability to compare the transposition of the TMCS Directive in the context of the UK regulatory regime. Notably, some duties appear in both stages given that the discharge of these duties is likely to span across the two stages.

Table 8.1: Duties of the CDM-C rearranged according to the preparation and execution stages

Duties of the CDM Coordinator	
Project preparation stage coordination duties	***Reg.***
Give suitable advice and assistance to the client regarding compliance with the client's duties under the regulations	20(1)(a)
Ensure that arrangements for coordination of health and safety measures during planning and preparation for the construction phase are implemented	20(1)(b)
Liaise with the Principal Contractor regarding information required for preparation of the construction phase plan, contents of the health and safety file and any design development information that may affect the planning and management of construction	20(1)(c)

Duties of the CDM Coordinator	
Project preparation stage coordination duties	***Reg.***
work	
Prepare where none exists the health and safety file and update/review for subsequent construction work	20(1)(e)
Take reasonable steps towards identifying and collecting preconstruction information	20(2)(a)
Promptly provide preconstruction information to all Designers, Contractors and the Principal Contractor	20(2)(b)
Take reasonable steps to ensure Designers comply with their duties and provide sufficient information about aspects of the design to assist other duty holders	20(2)(c)
Ensure notice is given to the Health and Safety Executive (or ORR)	21
Project execution stage coordination duties	***Reg.***
Prepare where none exists the health and safety file and update/review for subsequent construction work	20(1)(e)
Take reasonable steps to ensure Designers comply with their duties and provide sufficient information about aspects of the design to assist other duty holders	20(2)(c)
Take all reasonable steps during the construction phase to ensure cooperation between Designers and the PC in relation to any design or design change	20(2)(d)
Ensure that arrangements for coordination of health and safety measures during planning and preparation for the construction phase are implemented	20(1)(b)
Handover the health and safety file to the client at the end of the construction phase	20(2)(f)

Table 8.2: Duties of the PC rearranged according to the preparation and execution stages

Duties of the Principal Contractor	
Project preparation stage	***Reg.***
Prepare the construction phase plan before construction work and pay adequate attention to information provided by the designer	23(1)(a)
Take all reasonable steps to ensure that the construction phase plan identifies the risks to health and safety	23(2)
Consult contractors where necessary before finalising the part of the construction phase plan relevant to his work	22(1)(g)
Draw up site rules where necessary for health and safety, appropriate to the construction site/activities	22(1)(d)
Ensure that contractors are informed of the minimum amount of time required for preconstruction planning before actual construction work	22(1)(f)
Ensure all contractors have access to the relevant part of the construction phase plan before actual construction work	22(1)(h)
Ensure contractors are given sufficient time before construction work to prepare and provide welfare facilities and carry out work without risk	22(1)(i)
Ensure project notification particulars are displayed in a legible manner so as to be read by any worker engaged in the construction work	22(1)(k)
Liaise with the CDM Coordinator and Designers regarding any design/or change to design during the construction phase	22(1)(b)
Project execution stage duties	***Reg.***
Implement the construction phase plan so as to ensure the health and safety of all persons carrying out the construction work	23(1)(c)
Update , review and revise the construction phase plan when appropriate throughout the project	23(1)(b)
Ensure that the construction phase is planned, managed and monitored in a reasonably practicable manner, while facilitating cooperation and coordination between contractors and pursuance of the general principles of prevention	22(1)(a)
Liaise with the CDM Coordinator and Designers regarding any design/or change to design during the construction phase	22(1)(b)
Ensure provision of adequate welfare facilities throughout the construction phase	22(1)(c)
Offer reasonable directions to any Contractor when necessary to enable compliance with his duties under the Regulations	22(1)(e)
Ensure each contractor promptly provides construction activity information likely to be required by the CDM Coordinator for inclusion in the health and safety file	22(1)(j)
Take reasonable steps so as to prevent persons unauthorised to access the construction	22(1)(l)

Duties of the Principal Contractor	
Project preparation stage	***Reg.***
site	
Ensure site induction and training is provided to every worker carrying out the construction work	22(2)
Facilitate cooperation with workers engaged in the construction work and developing measures to ensure health, safety or welfare of workers and checking the effectiveness of such measures	24(a)
Consult workers or their representatives on matters regarding the project in line with their health, safety and welfare	24(b)
Ensure that workers or their representatives can inspect and take copies of any planning and management information, which relates to the project	24(c)

8.2.1 Transposing the provisions regarding appointments (Article 3)

The importance attached to early appointment of duty holders as expressed previously (see Chapter 4) is critical and widely accepted as good practice. A key finding in this research is the likelihood of duty holders to be appointed during the technical design stage or later. Consequently, an examination of the provisions of Article 3(1) of the TMCS Directive reveals that the appointment stage of the coordinators occurs in the early stages of the project. Article 3(2) states that the safety and health plan should be prepared earlier than setting up the site. Since it is the coordinator's obligation to prepare the safety and health plan in accordance with Article 5(b), it is reasonable to argue that the coordinator appointment occurs prior to setting up the site. Indeed, it is perceived good practice to make such an appointment sufficiently early (European Commission, 2011, p.38). Article 3(1) goes on to explain the basis for appointing the coordinators. It further suggests appointing one or more coordinators on a construction site with more than one contractor. To the contrary, the appointment criteria under the CDM Regulations is triggered by the duration of a project or the number of person days involved (see Regulations 2(3), 14(1), 14(2)), rather than the number of contractors present on site.

As for appointment of the coordinator, it is expressed in the TMCS Directive that he is appointed early, preferably during the design stage of a project given the importance of early coordination responsibilities. This is contained in Article 2(e), which suggests performing the coordinator's duties during the preparation of the project design. Clearly, the CDM 2007 are aligned with the TMCS in relation to the issue of the appointment stage to some degree. However, despite several views in support of the benefits of early appointment (see e.g. Baxendale and Jones, 2000; Anderson, 2003; Anderson 2010; ICE, 2011), the evidence in Chapter 7 suggests otherwise. It suggests that the CDM-Cs are typically appointed during the technical design stage, while the PCs are typically appointed during the construction phase. Even the few associations between the extent of discharge of duties and the early stages of appointment confirm this syndrome of late appointment. Once appointed early, the proactive contribution to the project design and other decisions by duty holders becomes conceivable.

8.2.2 Transposing the provisions regarding notification of a project (Article 3)

Compliance with project notification requires giving prior notice to the relevant authority. The study found that this duty executed by the CDM-C was typically discharged frequently. It was perceived to be the least difficult duty to discharge, yet least important. The results also show that the extent of its discharge is misaligned with the perceived degree of importance. However, what is undeniable is that it is transposed in the CDM 2007 to some degree, although there are salient differences as noted below.

Article 3(3) states that the Client or Project Supervisor is required to give prior notice for a project, particularly in the following circumstances: (i) construction work lasting longer than 30 working days where more than 20 workers are employed or (ii) construction work that exceeds 500 person days. Under the CDM Regulations however, notice is given by the CDM-C and applies when construction work exceeds 30 days or 500 person days of construction work (see Regulation 2(3)). The requirement concerning the number of workers employed is omitted under the CDM 2007.

Notably, given that notification is carried out during the project preparation stage (see Table 8.1), it is critical for the CDM-C to be appointed at the appropriate time, preferably, during the very early stages of design. This is inconsistent with the evidence that clearly shows a late appointment of the CDM-C.

8.2.3 Transposing the provisions regarding key documentation (Article 3)

An assessment of the regulations that correspond with such provisions in relation to preparation of key project documentation involved analysing the CDM Regulations duties concerning preparation of the safety and health plan and the H&S File. A list of the regulations relating to the above is clearly expressed in Tables 8.3a and 8.3b.

Once appointed, the coordinator develops a safety and health plan (see Article 5(b)), and the Client or Project Supervisor ensures that this is done before construction work begins. It is explained clearly in Article 5(c) that, a file containing relevant safety and health project particulars is prepared successively for the benefit of subsequent work. The CDM 2007 articulates these requirements within the duties discharged by the PC and the CDM-C. Notably, unlike the CDM Regulations, the TMCS Directive stipulates preparation of both documents during the project preparation stage, and as such, refers to duties of the coordinator appointed during that stage. Conversely, the coordinator appointed during the project execution stage (see Article 6(c)) carries out the responsibility to update and review the plan.

Table 8.3a: Corresponding regulations with the preparation of key documentation

Duties of the CDM Coordinator	
Project preparation stage	***Reg.***
Liaise with the Principal Contractor regarding information required for preparation of the construction phase plan, contents of the health and safety file and any design development information that may affect the planning and management of construction work	20(1)(c)
Project execution stage duties	***Reg.***
Prepare where none exists the health and safety file and update/review for subsequent construction work	20(1)(e)
Handover the health and safety file to the client at the end of the construction phase	20(2)(f)

Table 8.3b: Corresponding regulations with the preparation of key documentation

Duties of the Principal Contractor	
Project preparation stage	***Reg.***
Prepare the construction phase plan before construction work and pay adequate attention to information provided by the designer	23(1)(a)
Take all reasonable steps to ensure that the construction phase plan identifies the risks to health and safety	23(2)
Consult contractors where necessary before finalising the part of the construction phase plan relevant to his work	22(1)(g)
Ensure all contractors have access to the relevant part of the construction phase plan before actual construction work	22(1)(h)
Project execution stage duties	***Reg.***
Implement the construction phase plan so as to ensure the health and safety of all persons carrying out the construction work	23(1)(c)
Update , review and revise the construction phase plan when appropriate throughout the project	23(1)(b)
Ensure each contractor promptly provides construction activity information likely to be required by the CDM Coordinator for inclusion in the health and safety file	22(1)(j)

Since two different duty holders under the CDM Regulations discharge the duties relating to preparation of key documentation as demonstrated above, it is reasonable to conclude that the regulations fully transpose the TMCS Directive provisions. However, considering the extent of discharge of these duties, the empirical evidence suggests that only Regulation 23(1)(c) was frequently discharged, while the extent of discharge of the other duties varies. In terms of positive impact on H&S outcomes, it can be concluded that only ensuring contractors have access to the relevant part of the Construction Phase Plan before actual construction work (Regulation 22(1)(h)) and preparing the H&S File (Regulation 20(2)(e)) were perceived critical, which perhaps questions the significance of the other duties.

8.2.4 Transposing the project preparation stage general principles of prevention (Article 4)

The literature previously reviewed shows that duties of the Designer are underpinned by the Prevention through Design (PtD) concept (see Section 2.2.2). Bearing this in mind, the results presented in Chapters 6 discuss the practices pertaining to the discharge of duties of the Designer. The interviewees indicated that they undertook various practical steps to discharge their duties, some of which included: identifying unusual hazards; checking through the drawings to ensure that they are practical in terms of buildability; detecting hazards and risks by reviewing construction methods; and most importantly providing explicit information regarding the identified unusual hazards and risks. Indeed, it is well known and widely researched that there are significant benefits associated with early design decisions. In this way, duties of the Designer can potentially yield significant benefits. Take for example the obligations to avoid and eliminate risks, i.e.—Regulations 11(3) and 11(4). It was found that Designers discharged duties according to their terms of engagement, whereby in some instances, a specific framework was adopted which proved beneficial. It not only benefited the H&S aspect of the project, but also helped to improve project delivery in terms of time, budget, and collaborative working.

Based on the evidence, it became clearer that indeed the Designer’s role is crucial and imperative in terms of fulfilling requirements leading to compliance with the CDM Regulations. For example, issuing drawings with notes, specifying instructions to the concerned parties was a common practice. In other instances, it was common for Designers to rely on the expertise of other project team members, which is indeed a common practice (e.g. Gambatese, 2000; Price, 2010; Tymvios *et al.*, 2012), particularly in the case of complying with the CDM 2007.

Other practices actively pursued included, provision of information required for the subsequent development of the Construction Phase Plan and H&S File. The foregoing demonstrates that the Designer is expected to collaborate with other duty holders. For example, provision of design sufficient information (Regulation 11(6)) forms part of the preconstruction information provided by the Client and CDM-C in adhering to Regulations 10(1)(b), 20(2)(a) and 20(2)(b), and as such benefits other project stakeholders. Even provision of information during the project preparation stage is essential and in line with Article 4 of the TMCS Directive. Notably though, Article 4 refers to the Project Supervisor or Client as the duty holder tasked to discharge these provisions, however, in the context of the CDM 2007, it can be implied that the Designer's duties resonate with these provisions. For example, Article 6(2) of the Framework Directive requires employers to avoid, evaluate, and combat risks, which is similar to the duties of the Designer. It can therefore be inferred that provisions relating to the general principles of prevention during the project preparation stage are fully transposed (see also Regulation 7), although some duties go beyond the TMCS Directive provisions as explained below.

8.2.4.1 Project preparation stage: duties of the Designer

Table 8.4 contains duties of the Designer that correspond to Article 4 of the TMCS Directive. Arguably, it can be observed that of the six duties of the Designer discharged during the project preparation stage, Regulation 11(1) and 18(1) go beyond the requirements of the TMCS Directive. Additionally, even their extent of discharge was unclear from the evidence, which again questions the ability of the duty holders to collaborate.

Table 8.4: Duties of the Designer during the project preparation and execution stages

Duties of the designer	
Project preparation stage	***Reg.***
Designer to commence work only when sure that the client is aware of duties to be discharged role Regulations	11(1)
When preparing or modifying a design, the designer avoids foreseeable risks to the health and safety of any person	11(3)
Eliminate and reduce risks	11(4)
Designer to take into account provisions of the Workplace (Health, Safety and Welfare) Regulations 1992—particularly those relating to the design of, and materials used in, the structure	11(5)
Designer to provide design sufficient information to the other duty holders	11(6)
Commence work after appointment of the CDM-C	18(1)
Project execution stage	***Reg.***
Designer to provide design sufficient information to the other duty holders	11(6)
Assist the CDM-C in preparation of the H&S File as well as other duties	18(2)

8.2.4.2 Project execution stage: duties of the Designer

It was observed in Chapter 4 that the duties of the Designer are implicitly defined under the TMCS Directive, thus implied. However, further examination sheds light on the significance of these duties in terms of their interplay with the discharge of other duties during this stage. As indicated previously, the duties performed by the Designer largely conform to the PtD concept. In this way, offering a proactive approach to managing H&S related issues on construction projects. The duties of the Designer undertaken during the project execution stage are listed in Table 8.4 previously. Clearly, the Designer's role involves close collaboration with the other stakeholders.

Take for example, provision of design information; provided the design information is sufficient, preparation of Construction Phase Plan (Regulation 23(1)(a)) and preparation of the H&S File (Regulation 22(1)(a)) follows subsequently. Given this perception, it could be argued that insufficient design information can lead to incomplete project documentation as demonstrated in Chapter 6 (see Section 6.3.3). Although, the Designers' role is not explicitly expressed in the TMCS Directive, it is reasonable to conclude that Article 4 is considerably transposed. Arguably, some duties that go beyond the requirements of the directive invite amendment and further scrutiny by the HSE.

For example, it was unclear from the evidence to what extent the Designer assisted the CDM-C and likewise, the CDM-C found it difficult to ensure that Designers complied with their duties.

8.2.5 Transposing the project preparation stage coordination duties (Article 5)

Article 5 specifies the duties of the coordinator during the project preparation stage. These obligations include:

(a) coordinating the implementation of provisions relating to the general principles of prevention specified in Article 4 (Article 5(a));

(b) preparing the H&S Plan (Article 5(b)); and

(c) preparing the H&S File (Article 5(c)).

8.2.5.1 Project preparation stage: duties of the CDM-C

Table 8.1 contains duties of the CDM-C that correspond to the project preparation stage. From the examination of these duties, it is clear that the CDM 2007 meets these requirements. However, the extent of discharge of these duties varies given that they are discharged infrequently as evident from the results. It was also noticed that at least three of these duties were misaligned in terms of their extent of discharge and perceived degree of importance. Further, a recapitulation of the significant associations reveals inverse patterns. For example, discharging coordination arrangements (Regulation 20(1)(b)), with the perceived degree of difficulty to provide preconstruction information (Regulation 20(2)(b)) returns a negative correlation. Meaning that while one increases the other decreases, which in this case suggests an increase in the perceived degree of difficulty to provide preconstruction information as the coordination duty is discharged.

It therefore follows that the importance of timely and adequate provision of preconstruction information cannot be overemphasised. Without adequate preconstruction information, other duty holders may find it difficult to discharge their duties. However, the practical ways the CDM-Cs discharged this duty invites further research. It was expressed on numerous occasions that practically, what the CDM-Cs provided as preconstruction information in most instances was incomprehensible and as such was rarely used [e.g. interviewee ID1].

The preceding discussion demonstrates the multiplicity of issues associated with the CDM-C duties during the project preparation phase. Despite largely conforming to the TMCS Directive, the results show that there is need to question the effectiveness of the role in terms of accountability and compliance.

8.2.5.2 Project preparation stage: duties of the PC

The duties performed by the PC are central to the project preparation stage. For example, once the PC prepares the Construction Phase Plan (Regulation 23(1)(a)), it is beneficial to the majority of stakeholders particularly contractors for their subsequent work and the CDM-C for construction phase coordination purposes (Regulation 20(1)(c)). In this way, it is observed that other duty holders rely on the Construction Phase Plan; as such, its preparation is considered critical. Moreover, Section 8.2.3 already provides a discussion on duties involving the preparation of key documentation; therefore, this section concentrates on other obligations of the PC during the project preparation stage, as listed in Table 8.2 previously.

Of the nine duties in relation to the project preparation stage highlighted in Table 8.2, two were typically always discharged while the extent of discharge of the others varied, of which their extent of discharge was misaligned with the perceived degree of importance. The two duties involved drawing up site rules for H&S (Regulation 22(1)(d)) and ensuring project notification particulars are displayed (Regulation 22(1)(k)). It can be concluded therefore that the CDM 2007 does largely transpose the provisions stipulated under the project preparation stage of the TMCS Directive, although the practices associated with the discharge of the duties raises concerns.

8.2.6 Transposing the project execution stage coordination duties (Article 6)

Under Article 6, the coordinator appointed during the project execution stage is required to discharge the following duties:

(a) coordinating implementation of the general principles of prevention (Article 6(a));

(b) applying coordination principles as specified under Article 6 of the EU Directive 89/391/EEC (Article 6(b));

(c) reviewing and updating the health and safety plan (Article 6(c));

(d) encouraging cooperation between current stakeholders, including successive stakeholders on the same site (Article 6(d));

(e) coordinating arrangements to ensure proper implementation of work procedures (Article 6(e)); and

(f) ensuring only authorised persons gain access to the workplace (construction site) (Article 6(f)).

Under the CDM 2007, these duties are largely distributed across the CDM-C, and PC duty holders, as discussed below.

8.2.6.1 Project execution stage: duties of the CDM-C

As the name suggests, the CDM-C ensures implementation and coordination of H&S measures (see Regulation 20(1)(b)). Table 8.1 also lists the duties discharged by the CDM-C during project execution, consistent with the format of the TMCS Directive. It is also worth pointing out that these duties are critical because other responsibilities hinge on them, such as preparation of key documentation duties, discussed earlier (see Section 8.2.3).

The evidence shows that all duties of the CDM-C related to the project execution stage were not always discharged. At the same time, it was observed from the findings that duties requiring collaboration with other stakeholders were found to be difficult to discharge. Take for example the duty to ensure Designers comply with their duties (Regulation 20(2)(c)). It is perceived to be the most difficult duty to discharge. Further, it was proved statistically that its extent of discharge reflects its perceived degree of difficulty.

Indeed, these duties provide a platform for collaboration contrary to the evidence. The lack of proper coordination not only impedes the potential to avoid hazards, but also exacerbates their potential to occur. Coordination matters pertaining to H&S constantly demand participation of other project stakeholder, as demonstrated by the London 2012 Olympics project (e.g. Shiplee *et al.*, 2011; Frontline Consultants, 2012b; Webster, 2013). They came up with innovative solutions, tackled the challenge of undertaking a project of such complexity by ensuring early appointments of duty holders and the excellent Client leadership provided (Webster, 2013). This section has demonstrated that despite the CDM-C duties conforming to Article 6 of the TMCS Directive, discharging of these duties was insufficient.

8.2.6.2 Project execution stage: duties of the PC

As noted previously (see Section 8.2.5), the PC has the responsibility to prepare the Construction Phase Plan (Regulation 23(1)(a)). In line with the TMCS Directive (see Article 6(c)), it is obvious that the Construction Phase Plan may need updating from time to time during the project execution stage, due to design changes and the like (see e.g. Webster, 2013). This provision is accurately transposed in the CDM 2007 (Regulation 23(1)(b)), along with other complementing duties.

Of the twelve duties considered to be in line with the project execution stage (refer to Table 8.2), at least five were always discharged, while three were considered most important. From the findings, it was also observed that the extent of discharge of consulting workers or their representatives (Regulation 24(b)) was misaligned with its perceived degree of importance. Again, this raises doubt in terms of the degree of compliance on the part of the PC. However, it can be argued that all the duties during this stage conform to the provisions under Article 6 of the TMCS Directive.

8.2.7 Transposing the provisions on resourcing

Apart from specifying resourcing requirements for discharging the notification of a project (see Article 3(3)); resourcing requirements to perform the roles, are largely unspecified in the TMCS Directive.

Moreover, given the obvious differences in resourcing requirements due to project type and scope as demonstrated in Chapter 7 (see Section 7.9), it proved elusive to determine the precise resourcing requirements, as such invites further research. Notably, even in the CDM 2007, this issue of resourcing is largely unspecified, apart from providing generic provisions on duty holder competence requirements (see Regulation 4).

It can be argued that adequately resourced duty holders tend to discharge their duties sufficiently. Contrary to this presupposition, the results showed no correlation between the extent of discharge of duties of the CDM-C and adequate resourcing. On the other hand, 50% of the duties of the PC yielded a positive correlation between the extent of discharge and the adequacy of resourcing, which signals the inadequacy of resourcing. During the project preparation stage, it was reported that typically 20 man-days were required for both duty holders. Whereas, during the project execution stage, at least not more than two man-days per week for the CDM-C and not more than five man-days for the PC were required. Perhaps more resourcing needs to go into the project execution phase to ensure that the duties are always discharged. As for fulfilling dual roles, it was largely rare for CDM-C to be appointed in two separate roles, which also signals a lack of capacity and resourcing. On the other hand, it was often for the PC to discharge the function of a Main Contractor simultaneously.

8.3 PROPOSED CHANGES TO THE CONSTRUCTION (DESIGN AND MANAGEMENT) REGULATIONS 2007

The discussion in the previous section draws conclusions based on the degree of alignment between the TMCS Directive and the CDM 2007 in relation to findings of this study. It was observed from the literature that the primary legislation (HSWA 1974) as well as the subsequent regulations are developed on the premise of a facilitative approach, rather than a prescriptive one, thereby triggering a flexible approach to adhering to these laws. It has been shown from the evidence that this approach maybe questionable because of the variations in the discharge of duties and the misalignment with importance. Such problems mostly manifest in the duties of the CDM-C and PC.

This section therefore highlights these problems as perceived by the research participants. Although these views may not directly address specific duties, they offer some degree of assessment—describing overarching concerns, thus providing insight regarding the extent of compliance.

8.3.1 Changes in the role of the Designer

The role played by the Designer as already mentioned is critical towards improved H&S (e.g. Wright *et al.*, 2003; Tymvios *et al.*, 2012). Given this importance, practices associated with discharging duties of the Designer were established from the findings. The evidence suggests that Designers largely comply with their duties, although in a varied manner. It also emerged that most of the challenges faced, were associated with collaborating with other duty holders. As such, it is no surprise that there was also a tendency to take on dual roles, particularly the Designer and CDM-C combination. The implication of undertaking dual roles requires further investigation, thus beyond the scope of this study. Although it was conceived that such practices were of no benefit. For example, one respondent noted that: "[…] a Designer is not a qualified CDM-C and should not try to [take on] dual roles [CDMC Respondent 22]". Besides this issue, other recurring changes expressed by the CDM-Cs and PCs include:

- greater awareness of responsibilities and accountability of design decisions in line with improved safety management;
- engaging with the CDM-C at an early stage;
- improved design risk assessment;
- insufficient resourcing and training, however, their skillset is questionable; and
- improving communication with other duty holders.

8.3.2 Changes in the role of the CDM-C

Numerous concerns surround the role of the CDM-C. These include a lack of their presence during the project execution stage, lack of compliance and competence issues, chief of which is the lack of understanding of duties (e.g. Dalby, 2009; ICE, 2011). It is such concerns that invite the need to investigate areas of improvement.

Based on the views put forward regarding changes to the role of CDM-C, the recurring issues also partly inform the remedial actions and change drivers such as the Main Contractor replacing this duty holder. Thus, the changes that were considered reasonable as pointed out by the various participants were:

- the complete removal of role
- adequate provision of preconstruction information
- include duty to visit the site more regularly (hands on/proactive approach)
- sufficient involvement during (pre)construction
- early appointment
- increased decision involvement
- adequate preparation of the H&S File.

These proposed changes confirm the lack of collaboration and accountability on the part of the CDM-C, and perhaps invites the need to consider replacing the CDM-C duty holder role with an existing duty holder (e.g. main contractor).

8.3.3 Changes in the role of the PC

The duties of the PC are just as important as the CDM-C's duties and largely conform to the TMCS Directive provisions. The main proposed changes pertaining to this role established from the research participants are as follows:

- reducing the amount of generic paperwork
- producing evidence supporting implementation of the Construction Phase Plan
- earlier involvement in design and planning.

8.3.4 Changes in the role of the Client

The importance of the role played by the Client in the construction industry is well known; strategic for overall project performance (e.g. Thompson, 1991; Kometa *et al.*, 1994; Briscoe *et al.*, 2004). For example, in their study Briscoe *et al.* (2004) identify client-leadership as influential in supply chain integration; enhancing the successful delivery of projects in the UK construction industry. The same argument can be made in relation to improved CDM implementation. This is unsurprising given that the Clients' organisation takes the initial step to procure the development (e.g. Briscoe *et al.*, 2004, p.199) and appoints the CDM-C and PC where a project is notifiable (see Regulation 14(1), 14(2) and Article 3). The findings from three case studies examined by Briscoe *et al.* (2004) showed that collaboration with the other project stakeholders led by the Client was critical and perceived as beneficial.

Given the importance the Client organisation brings to the construction process as demonstrated above, it was necessary to examine the changes required in their role under the CDM Regulations. Listed below, are the recurring proposed changes from the research participants considered essential in the role of the Client towards improved CDM implementation:

- early appointment, collaboration, and cooperation with other duty holders;
- allow sufficient time for mobilisation;
- early involvement in design decisions;
- greater accountability for their legal responsibilities;

- sufficient input towards provision of preconstruction information; and
- inclusion of domestic clients.

From the discussion above, proposals for change emerge as summarised in Table 8.5. Most of the changes concerning the various duty holders corroborate earlier findings such as difficulty in collaboration among duty holders and so forth. For example, ensuring Designers comply with their duties (Regulation 20(2)(c)) was found to be the most difficult duty and its extent of discharge was misaligned with the perceived degree of importance. Similarly, the extent of discharge of ensuring contractors are given sufficient time before commencement of construction work (Regulation 22(1)(i)) was also misaligned with its perceived degree of importance. As such, the remedial actions and corresponding change drivers are partly informed by the recurring and overlapping proposed changes.

Table 8.5: Changes to the CDM 2007 informing the remedial actions and key drivers

Proposed changes to the CDM 2007	**Duty holder impacted by proposed change**			
	Client	*Designer*	*CDM-C*	*PC*
Greater awareness of duties and accountability	✓	✓	✓	✓
Early design stage involvement	✓	✓	✓	✓
Managing design risk in a proportional manner		✓		
Remove role of CDM-C		✓		✓
Provision of preconstruction information	✓		✓	
Increased involvement during the project preparation	✓		✓	✓
Increased involvement during the project execution stage			✓	
Early appointments (e.g. CDM Coordinator, Principal Contractor)	✓		✓	
Adequate preparation of the H&S File			✓	✓
Reduction in paperwork				✓
Evidence supporting implementation of the Construction Phase Plan				✓
Better collaboration and cooperation	✓			✓
Allow sufficient/adequate time for CDM mobilisation period	✓		✓	✓
Inclusion of domestic client	✓			

Source: Fieldwork undertaken by author

8.4 THEMES INFORMING THE REMEDIAL ACTION FRAMEWORK

This section provides an insight into the developed remedial action framework informed by the research results and the foregoing discussions. The framework comprises of three themes discussed further in Sections 8.4.1, 8.4.2, and 8.4.3. By considering the research results and emerging implications, a flowchart describing implementation of the CDM 2007 (see Figure 8.2) and the influence network model by Bomel (2004) support the developed remedial action framework. It comprises of two categories, namely remedial actions and change drivers.

8.4.1 Theme 1: Collaboration

The main emerging themes from the preceding discussion are consistent with supply chain integration drivers (see e.g. Akintoye *et al.*, 2000; Akintoye and Main, 2007; Cao and Zhang, 2011) and integrated project delivery (IPD) (e.g. Raisbeck *et al.*, 2010; Lahdenpera, 2012). Despite considering supply chain management (SCM) to be at its infancy at the time, Akintoye *et al.* (2000) pointed out the benefits of SCM such as, improved production planning and key purchasing. In the same context, it can be argued that strategic collaboration in the main, triggers improved partnerships (Akintoye *et al.*, 2000).

The specific benefits of collaboration from a contractors' perspective include shared risk, access to innovation and technology, improved response to market needs, resource efficiency, and meeting client requirements (Akintoye and Main, 2007). More recently, IPD has received significant attention and it has been labelled as a strategic procurement structure towards collaborative contracting. Raisbeck *et al.* (2010) observed that IPD has the potential to share risks amongst project parties. Lahdenpera (2012) also argued that because of the fragmented nature of the construction industry, IPD has the potential to trigger early involvement and integration of versatile expertise and systems. One such system that has grown to prominence is BIM.

It is against such a background that supply chain integration and IPD are considered relevant in the context of successful implementation of the CDM Regulations. This is consistent with the suggestion for changes regarding early stakeholder commitment during design and construction. Again, the importance of duty holder involvement was explicitly expressed in a report prepared for the HSE by Maloney and Cameron (2003). Further, they explain that an individual may choose to be involved or otherwise, given that it is a conscious choice that one makes. Such a decision hinges on various factors influencing involvement as derived below (Maloney and Cameron, 2003, p.16):

$$\text{Involvement} = f\ (\text{Opportunity, Capability, Motivation}).$$

Thus, it requires identifying the appropriate stage of involvement (opportunity), the possession of sufficient knowledge (competence and training) and willingness and desire to exert proportional effort (facilitation and motivation) (Maloney and Cameron, 2003).

8.4.2 Theme 2: Accountability and compliance

Having identified the first theme as collaboration, complying with the actual duties and responsibilities is also paramount. From a legal perspective, Burby *et al.* (1998) identified two main conventional philosophies that improve compliance with regulations. They point out these philosophies as (i) systematic enforcement and (ii) facilitation. The former emphasises a uniform approach, while the latter encourages cooperation, flexibility, and use of incentives. The findings of the study conducted by Burby *et al.* (1998) suggest that enforcement with a more flexible approach enhances commitment for voluntary compliance with the regulations. This view, suggesting a flexible approach to enhance compliance with regulations, resonates well with the CDM Regulations and appears to also support the TMCS Directive and the HSWA 1974 ethos.

Considering the nature of the construction industry in terms of bespoke projects and varied procurement routes, compliance with the regulations in a flexible manner seems to be a logical approach to adopt. For example, provision of preconstruction information will be influenced by the project type and complexity. Moreover, industry commercial pressures (e.g. Frontline Consultants, 2011) and the multifaceted nature of CDM implementation, requires careful scrutiny to improve its facilitation as demonstrated by the third theme.

8.4.3 Theme 3: Facilitation

Enforcement and execution of duties therefore requires continuous learning and revising guidelines and codes of practice. This promotes best practice towards CDM implementation improvement. Training has been recognised as a key factor towards H&S improvement (e.g. Bomel Limited *et al.*, 2006). Moreover, the role of early decision making to encourage optimal discharge of duties is central to CDM implementation. This is evident from the results with comments regarding changes required such as 'more design risk assessment', 'design decision involvement', 'early design involvement' and 'early involvement in design decisions'. This theme also resonates with the non-prescriptive principle embodied in the primary H&S regime (see Section 3.1). Figure 8.1 shows the relation of the emerging themes from the study.

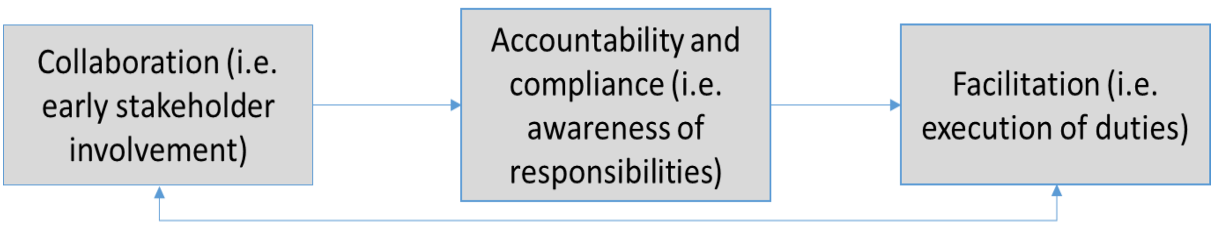

Figure 8.1: Themes informing the remedial action framework (improvement process)

Further, to facilitate such improvement, the role of HSE and other industry stakeholders is crucial as demonstrated by a study conducted by Bomel Limited (2004). They argued that regulations had the most far-reaching impact on improved H&S outcomes, of which they defined the regulatory influence as compliance with CDM duties. The model developed by Bomel Limited (2004) partly informs the application of the remedial action framework as discussed in the next section. It facilitates the process of improved CDM implementation and secures H&S outcomes by considering the influences at three levels (i.e. direct, organisational, and regulatory).

8.5 THE REMEDIAL ACTION FRAMEWORK (*Wiin-CDM*)

Figure 8.2 explicitly illustrates the key requirements to comply with the CDM 2007, underpinned by collaboration, accountability and compliance, and facilitation.

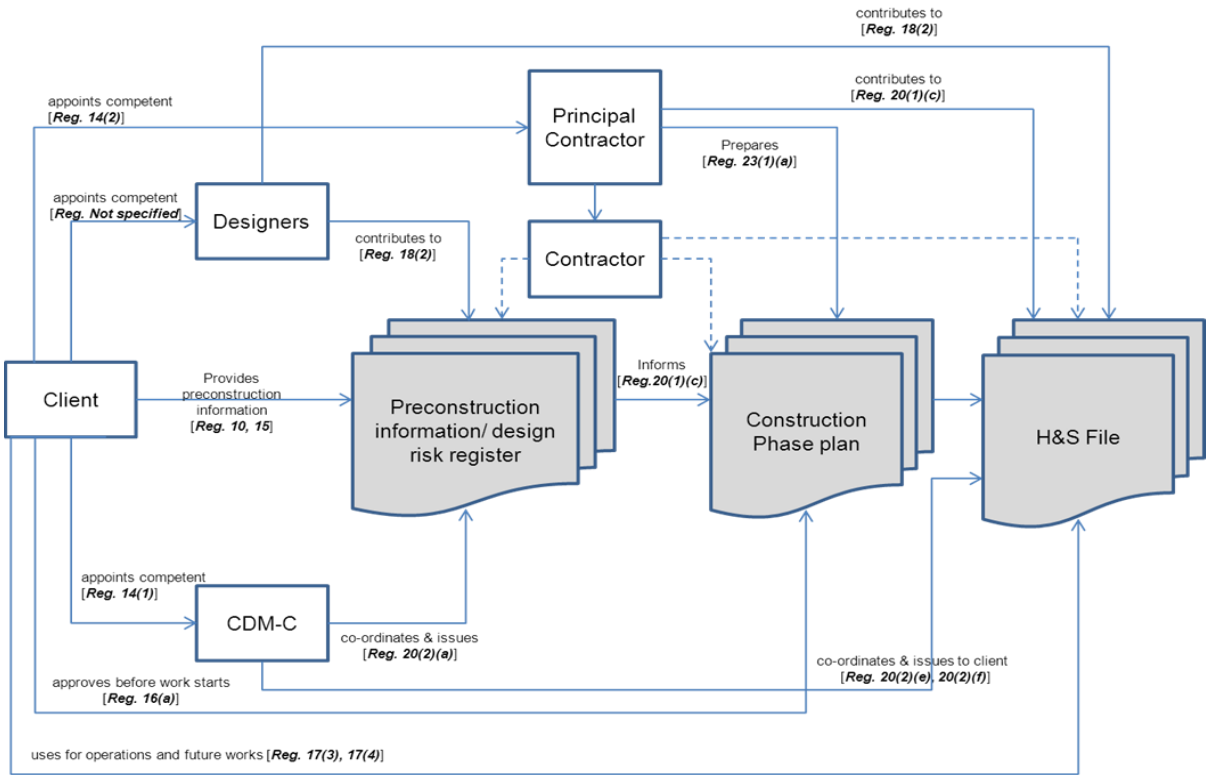

Figure 8.2: Duty holder collaboration under the CDM Regulations 2007 (CDM 2007)

The late appointment of duty holders impedes the timely discharge of duties leading to inadequate CDM implementation (e.g. Dalby, 2009; Frontline Consultants, 2011, 2012a).

Moreover, the empirical evidence analysed in Chapter 7, also confirms that duty holders are largely appointed in the latter part of design development. Given this observation, it is reasonable to argue that provided a duty holder is appointed earlier, they may contribute to early decision-making. This view is consistent with the argument that early design efforts provide an intervention mechanism for preventing occupational H&S hazards (see e.g. Behm, 2005; Gambatese *et al.*, 2008; Lingard and Wakefield, 2013). As such, the proposed remedial actions and corresponding change drivers derived from the results are detailed in Table 8.6 and Figure 8.3.

Table 8.6: Proposed remedial actions and change drivers

Theme(s)	Remedial action(s)	Corresponding change driver(s)
Collaboration	• Include provisions for specific appointment stage of duty holders to trigger adequate CDM mobilisation period among others • Proactive collaboration and early duty holder involvement by applying collaborative procurement tools such as Building Information Modelling (BIM) • Ensure adequate arrangements for coordination of H&S measures during planning and preparation for the construction phase • Include provisions for domestic clients	• Management leadership • Equip duty holders with appropriate BIM competence • Provide adequate resourcing throughout the (pre)construction phase
Accountability and compliance	• The main contractor to replace the CDM-C duty holder and discharge coordination duties • Provide proportionate resourcing to reflect specific risk assessment and competence requirements • Include a complete as-implemented Construction Phase Plan in the H&S File • Industry/academic bespoke training and curriculum development to trigger and encourage optimal discharge of duties • Wider dissemination/sensitization of breaches, offences and prosecutions	• Industry/academic driven training to equip the main contractor with sufficient knowledge on discharging coordination duties • Proactive participation of duty holders in developing CDM compliance documentation • Equip duty holders with sufficient knowledge on the consequences of breaches/prosecutions and subsequent penalties (e.g. fines and imprisonment) through provisions within standard form contracts
Facilitation	• Amend the ACoP to provide guidance on early decision making involvement • Amend the ACoP to provide guidance on sufficient provision of preconstruction information • Amend the ACoP to provide guidance on specific appointment stage decision • Amend the ACoP to provide guidance on determining what resources are adequate for a particular project	• Industry/academic training to equip duty holders with sufficient knowledge on the benefits of early decision making involvement • Industry/academic training to equip duty holders with sufficient knowledge on provision of timely and adequate preconstruction information

8.5.1 Implementation of remedial actions

The findings first revealed that the appointment stage of CDM-Cs and PCs is typically during the late stages of design, which signals that they have little to offer to eliminate risks and hazards upstream (e.g. Weinstein *et al.*, 2005; Fadier and De la Garza, 2006). This is a significant finding of the study, which confirms that little time is spent on CDM mobilisation, evident from the lack of collaboration amongst the various duty holders. This issue of CDM mobilisation was a prominent proposed change suggested by the research participants. However, not only does early appointment benefit the CDM mobilisation period, it also enhances the timely discharge of duties and improved integrated working that is compatible with CDM implementation (e.g. Webster and Lloyd-Kendall, 2012; Webster, 2013).

The other issues highlighted from the findings show variations in the discharge of duties and misalignment with the degree of importance to impact H&S management. Implementation of the remedial action framework is discussed in accordance with the Influence Network (IN) model developed by Bomel (2004) (see Figure 2.4) towards improved H&S outcomes because of its wide application. Over 30 workshops conducted by the HSE and other regulators and companies have benefited from this model (Webster and Lloyd-Kendall, 2012) which suggests its relevance to CDM implementation as already established in the literature review (see Section 2.2.5). Other research later refined this model to include two new factors, one at the environmental level and the other at the organisational level (see Webster and Lloyd-Kendall, 2012). Since the model suggests that regulations have the most far-reaching influence towards H&S improvement, its relevance and application to the remedial action framework is plausible. In the context of this study, Table 8.7 shows the CDM stakeholder responsible at various levels.

Table 8.7: CDM stakeholders reflected in the influence network

Influence level	CDM stakeholder responsible
Direct level	CDM duty holders
Organisational level	CDM duty holders
Policy level	CDM duty holders, HSE, Industry bodies and other stakeholders
Environmental level (regulatory)	HSE, Industry bodies and other stakeholders

Adapted: Bomel (2004)

8.5.1.1 Direct level influence(s)

At the direct level, there are 14 factors identified by the 'IN' model. Of these, competence, compliance, and team working are the most relevant factors to the proposed remedial actions. This means, proactive collaboration and early duty holder involvement by applying collaborative procurement tools such as BIM was considered to be at the direct influence level. Implementation of this remedial action is expected to be discharged by the duty holders.

8.5.1.2 Organisational and policy levels of influence(s)

The organisational and policy level includes 12 factors of which training, procedures, management, and communication of information are the most relevant to the proposed remedial actions. At the policy influence level, there are seven factors, of which two stand out. These are company standards and organisational structure, which reinforce the organisational level factors. The remedial actions at these levels include ensuring adequate arrangements for coordination of H&S measures, providing proportionate resourcing, including a complete as implemented Construction Phase Plan in the H&S File and duty holder training to encourage optimal discharge of duties. It is predicted that duty holders are best placed to implement these remedial actions within their organisations.

8.5.1.3 Regulatory level influence(s)

The environmental level comprises of five factors of which the regulatory influence is the most relevant to the remedial actions. This level captures eight of the remedial actions, namely:

(i) including provisions for the specific appointment stage of duty holders;

(ii) including provisions for domestic clients;

(iii) replacing the CDM-C role;

(iv) wider dissemination of breaches;

(v) amendment of ACoP to provide guidance on early decision making involvement;

(vi) amendment of ACoP to provide guidance on sufficient provision of preconstruction information;

(vii) amendment of ACoP to provide guidance on specific appointment stage decision; and

(viii) amendment of ACoP to provide guidance on determining what resources are adequate for a particular project.

At this level, the HSE, industry bodies and other construction industry stakeholders are best placed to implement these remedial actions as depicted in Table 8.9.

8.5.2 Implementation of change drivers

The change drivers correspond to the remedial actions. Similar to the discussion above, they are aligned with the influence levels and factors depicted in the model by Bomel (2004). Notably, the change drivers overlap across all the four influence levels as established in the subsections below.

8.5.2.1 Direct level influence(s)

The factors at this level relevant to the change drivers are similar to the ones identified in Section 8.5.1.1. Of the eight change drivers, it is predicted that two have a direct influence towards CDM implementation improvement. These are equipping duty holders with the appropriate BIM competence and proactive participation of duty holders in developing

CDM compliance documentation. As such, the duty holders themselves need to introduce these change drivers within their organisations.

8.5.2.2 Organisational and policy levels of influence(s)

At this level, five of the change drivers are relevant. These include management leadership, and provision of adequate resourcing, while others encourage training, that is:

(i) training of the Main Contractor to adequately discharge coordination duties;

(ii) training of duty holders on the benefits of early decision making involvement; and

(iii) training of duty holders on timely and adequate provision of preconstruction information.

At this level is anticipated that both duty holders and the HSE including other industry stakeholders have a significant role to play. For example, training the Main Contractor regarding coordination duties requires a consistent approach across the industry.

8.5.2.3 Regulatory level influence(s)

The change driver relevant at this level is equipping duty holders with sufficient knowledge on the consequences of breaches, prosecutions, and subsequent penalties. This can be achieved through provisions within industry standard form contracts. Which means that the HSE and relevant construction industry bodies need to perform this task in partnership, given that the HSE is the enforcement authority (see Section 3.2).

IMPROVED CDM IMPLEMENTATION AND H&S OUTCOMES

REMEDIAL ACTIONS (RAs)

Direct level influence(s) (CDM duty holders)

RA1: Proactive collaboration and early duty holder involvement by applying collaborative procurement tools such as BIM

Organisational and Policy level influences (CDM duty holders)

RA2: Ensuring adequate arrangements for coordination of H&S measures
RA3: Providing proportionate resourcing to reflect specific risk assessment and competence requirements
RA4: Include a complete as-implemented Construction Phase Plan in the H&S File
RA5: Duty holder training and curriculum development to encourage optimal discharge of duties

Regulatory level influences (HSE and Industry bodies)

RA6: Include provisions for specific appointment stage of duty holders
RA7: Include provisions for domestic clients
RA8: Replace role of the CDM-C with the Main Contractor
RA9: Wider dissemination of breaches, offences and prosecutions
RA10: Amend the ACoP to provide to provide guidance on early decision making involvement
RA11: Amend the ACoP to provide guidance on sufficient provision of preconstruction information
RA12: Amend the ACoP to provide guidance on specific appointment stage decision
RA13: Amend the ACoP to provide guidance on determining what resources are adequate for a particular project

CHANGE DRIVERS (CDs)

Direct level influences (CDM duty holders)

CD1: Equipping duty holders with the appropriate BIM competence
CD2: Proactive participation of duty holders in developing CDM compliance documentation

Organisational and Policy level influences (CDM duty holders)

CD3: Management leadership
CD4: Provide adequate resourcing throughout (pre)construction phase
CD5: Training the Main Contractor to adequately discharge coordination duties
CD6: Training of duty holders on the benefits of early decision-making involvement
CD7: Training of duty holders on timely and adequate provision of preconstruction information

Regulatory level influence(s) (HSE and Industry bodies)

CD8: Equip duty holders with sufficient knowledge on the consequences of breaches. prosecutions and subsequent penalties through provisions within standard form contracts

Figure 8.3: The Remedial Action Framework for improved CDM implementation (*Wiin-CDM*)

The remedial action framework can thus be expressed mathematically using the generic regression model (see Field, 2009), that is:

CDM Performance improvement (Y) = $\beta_o+\beta_1 RA_1+\beta_2 RA_2+.....+\beta_{13} RA_{13}+\varepsilon_i$

Where Y = the outcome variable

β_1 = the coefficient of the first predictor RA_1

β_2 = the coefficient of the second predictor RA_2

β_{13} = the coefficient of the 13th predictor RA_{13}

ε_i = the difference between the predicted and observed value of Y for the ith subject.

Table 8.8 and Figure 8.4 provide a summary of the combinations for implementation of the remedial action framework.

Table 8.8: Remedial actions and change drivers combination

Remedial Actions	Change drivers
RA1	CD1, CD3
RA2	CD1,CD3,CD5,CD6,CD7
RA3	CD1, CD2,CD3, CD4, CD5, CD6, CD7
RA4	CD1, CD2
RA5	CD1, CD2, CD3, CD4, CD5, CD6, CD7
RA6	CD6
RA7	CD3, CD4
RA8	CD4,CD5
RA9	CD8
RA10	CD6
RA11	CD7
RA12	CD3
RA13	CD4

From Table 8.8 it can be observed that RA3 (i.e. providing proportionate resourcing to reflect specific risk assessment and competence requirements) and RA5 (i.e. duty holder training and curriculum development to encourage optimal discharge of duties) had the highest number of combinations. While RA2 (i.e. ensuring adequate arrangements for coordination of H&S measures) had five combinations. Whereas, CD3 (i.e. management leadership) had the highest number of combinations corresponding to the remedial actions. As for CD1 (equipping duty holders with the appropriate BIM competence), CD4 (providing adequate resourcing throughout the preconstruction and construction phase), and CD6 (training of duty holders on the benefits of early decision-making involvement), they each had five combinations as demonstrated by Figure 8.4.

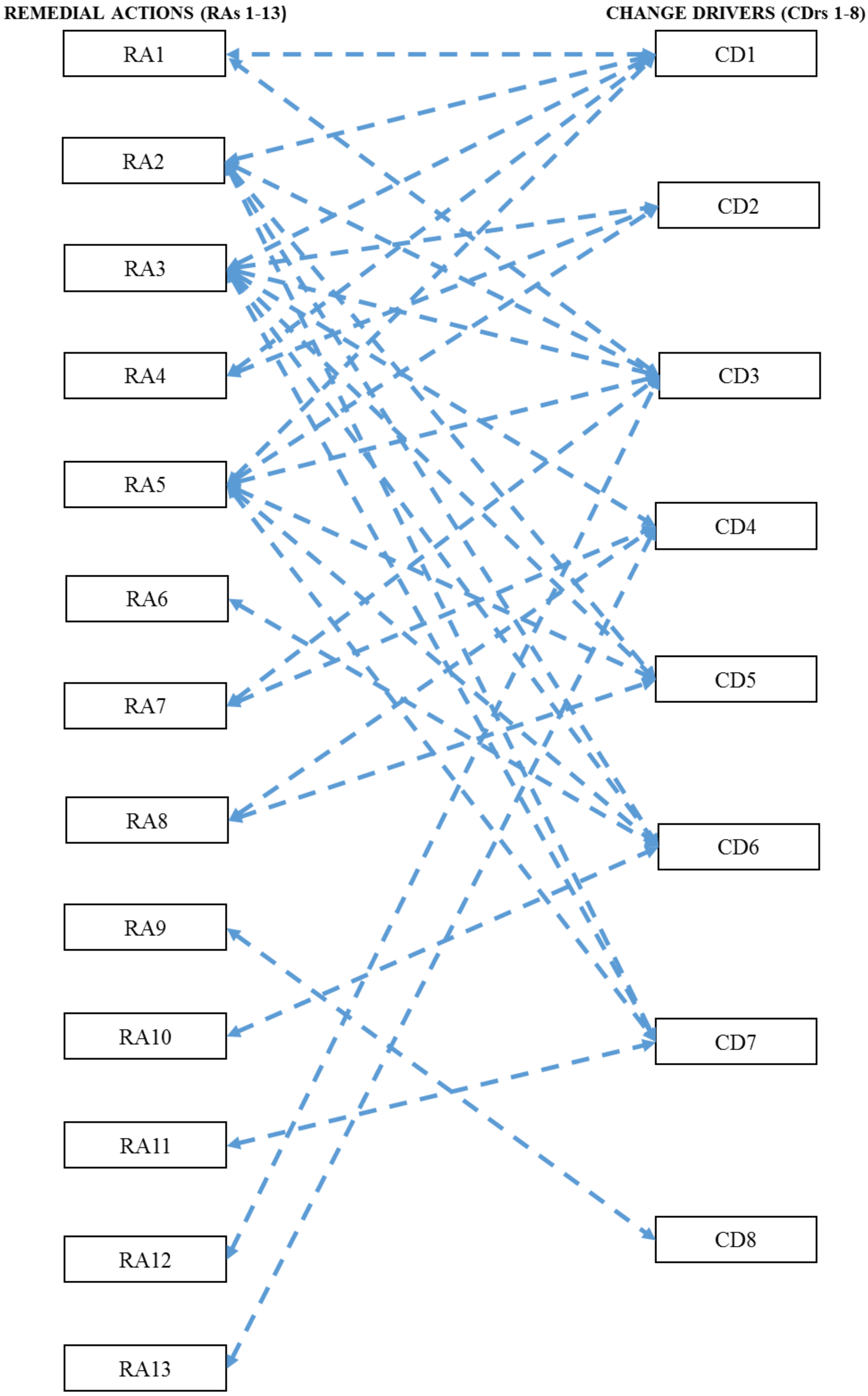

Figure 8.4: Remedial action and change drivers combination

8.6 CHAPTER SUMMARY

Having examined the provisions within the TMCS Directive and those within the CDM Regulations, and analysed the implications of the findings based on primary data, a remedial action framework is developed. It consists of 13 remedial actions and 8 change drivers, largely informed by the research results. To determine the viability of the remedial action framework, Chapter 9 presents results from the validation. This was undertaken by evaluating the proposed remedial actions and change drivers.

CHAPTER 9: VALIDATION OF THE REMEDIAL ACTION FRAMEWORK AND IMPLICATIONS FOR FUTURE REFORM

9.0 INTRODUCTION

The previous chapter provides a discussion on the developed remedial action framework. The purpose of this penultimate chapter of the thesis is to present results pertaining to the validation of the developed remedial action framework. A discussion highlighting the main outcomes of the validation is presented, after which implications for future reform are succinctly drawn. This chapter also partially meets the fifth objective of the study.

9.1 THE REMEDIAL ACTIONS AND CHANGE DRIVERS

Having established that there is considerable scope for CDM implementation improvement, the study participants evaluated the proposed 13 remedial actions and 8 corresponding change drivers. In total, 64 study participants expressed interest in receiving the research report containing the remedial action framework. Of the 64 study participants invited to validate the remedial action framework, 25 acknowledged receipt of the research report. Out of 25, 15 fully completed the evaluation of the proposed remedial actions and change drivers. The participants were composed of seven CDM-Cs, five PCs and three Designers; thus representing a 60% response rate (see Table 9.1). Moreover, this response was achievable after several reminders sent to the participants. To ease the response burden, I also incorporated the validation instrument into a web link; created using a free online survey platform (esurveyspro, 2013).

The results pertaining to the evaluation of the remedial actions and change drivers are ranked according to the relative indices (RI) in terms of priority to implement as summarised in Section 9.1.1 (see also Appendix 8).

Table 9.1: Profile of validation participants

No.	CDM Role held	Professional background	Position in organisation	Years of experience
1	CDM-C	Building Engineer	Director	25
2	CDM-C	Civil Engineer	Director	40
3	CDM-C	Architect	Senior CDM Coordinator	28
4	CDM-C	Architect	Senior CDM Coordinator	30
5	CDM-C	Quantity Surveyor	Senior CDM Coordinator	31
6	CDM-C	Building Surveyor	CDM Coordinator	23
7	CDM-C	Civil Engineer	CDM Coordinator	15
8	PC	Building Engineer	Health and Safety Director	25
9	PC	Environmental Engineer	Health and Safety Manager	25
10	PC	Civil Engineer	Health and Safety Manager	30
11	PC	Construction Management	Health and Safety Advisor	37
12	PC	Project Management	Health and Safety Director	28
13	Designer	Electrical Engineer	Head of Safety	24
14	Designer	Civil Engineer	Principal Associate	38
15	Designer	Civil Engineer	Director	40

9.1.1 Analysis of responses

The analysis of the responses reveals that the majority of the remedial actions and corresponding change drivers are considered feasible to implement. The results indicate that the top three most important remedial actions are:

(i) ensuring adequate arrangements for coordination of H&S measures during planning and preparation for the construction phase;

(ii) including provisions for the specific appointment stage of duty holders; and

(iii) amending the ACoP to provide guidance on determining what resources are adequate for a particular project.

One relates to the organisational level of influence, while two relate to the environmental level (regulatory). Which means that duty holders and the HSE have an important role to play to improve CDM implementation. Surprisingly, the remedial actions to include provisions for domestic Clients, replacement of the CDM-C role by the Main Contractor, and inclusion of an as-completed CPP in the H&S File are considered least important, thus unlikely to improve H&S outcomes, or if incorporated, may result in bureaucratic tendencies. As for the change drivers, the following three are considered practical to implement by the duty holder at the direct and organisational levels of influence:

(i) management leadership;

(ii) proactive participation of duty holders in developing the H&S File; and

(iii) training to equip duty holders with sufficient knowledge on provision of timely and adequate preconstruction information.

This signals that duty holders are willing to collaborate and acquire sufficient knowledge on practical ways of providing adequate preconstruction information. Notably though, despite its potential as a tool to improve interdependent working amongst duty holders and reduce paperwork, BIM competence is considered as the least important change driver in terms of practicality and cost. This outcome is surprising given its potential as a collaborative tool. Moreover, its endorsement by the UK Government and prominence in the recent past is encouraging yet questionable in terms of its implementation.

In addition, undertaking a correlation analysis reveals nine statistically significant positive associations between the remedial actions and change drivers (see Appendix 9). This outcome reinforces the view that there is a direct relationship between the remedial actions and change drivers. Thus, it can be argued that they are not mutually exclusive given that they can occur at the same time and significantly complement each other. Of the nine observed positive correlations, four yield a strong strength given the correlation coefficient of greater than .5 (see Cohen, 1988). This implies that they are unlikely to happen by chance, more so given that the observed p values are < 0.01. These four positive associations are:

- ensuring adequate arrangements for coordination of H&S measures during planning and preparation for the construction phase and management leadership (r = .886, p = .000, n = 15, significant at level 0.01);
- amend the ACoP to provide guidance on specific appointment stage decision and training to equip duty holders with sufficient knowledge on the benefits of early decision making involvement (r = .703, p = .004, significant at level 0.01);

- amend the ACoP to provide guidance on sufficient provision of pre-construction information and proactive participation of duty holders in developing the H&S File (r = .656, p = .008, significant at level 0.01); and
- amend the ACoP to provide guidance on specific appointment stage decision and industry/academic driven training to equip duty holders with sufficient knowledge on provision of timely and adequate pre-construction information (r = .629, p = .009, significant at level 0.01).

Further, the order of priority in terms of implementation of the remedial actions and change drivers for future reforms going by the relative indices (RI) is listed in Tables 9.2 and 9.3 (see also Figure 9.1.). A critical inspection of the results reveals four remedial actions that yielded a high variability as indicated by the standard deviation over 1.0; as such, maybe considered for further refinement. For example, assuming the role of the CDM-C by the Main Contractor was perceived unlikely to improve CDM implementation as reaffirmed by the validation participant (3): " […] giving the responsibility for CDM [coordination] to an existing duty holder has manifestly over the last twenty years proved unwilling and/ or unable to expedite such duties […]".

Table 9.2: Evaluation of the proposed Remedial Actions (RAs)

Description	Mean	Median	Std Dev	RI	Rank
RA2: Ensure adequate arrangements for coordination of H&S measures during planning and preparation for the construction phase	4.200	4.000	0.561	84.08	1
RA6: Include provisions for specific appointment stage of duty holders	4.133	4.000	0.640	82.68	2
RA13: Amend the ACoP to provide guidance on determining what resources are adequate for a particular project	4.133	4.000	0.743	82.66	3
RA1: Proactive collaboration and early duty holder involvement by applying collaborative procurement tools such as BIM	4.000	4.000	0.756	80.08	4
RA12: Amend the ACoP to provide guidance on specific appointment stage decision	4.000	4.000	0.756	80.08	4
RA3: Provide proportionate resourcing to reflect specific risk assessment and competence requirement(s)	4.000	4.000	0.655	80.00	5
RA11: Amend the ACoP to provide guidance on sufficient provision of preconstruction information	4.000	4.000	0.655	80.00	5
RA10: Amend the ACoP to provide guidance on early decisions involvement	4.000	4.000	0.534	79.92	6
RA5: Industry/academic bespoke training and curriculum development to trigger and encourage optimal discharge of duties	3.933	4.000	1.011	78.64	7
RA9: Wider dissemination/sensitization of breaches, offences and prosecutions	3.733	4.000	0.799	74.64	8
RA4: Include a complete as-implemented Construction Phase Plan in the H&S File	2.933	4.000	1.280	58.64	9
RA8: The main contractor to replace the CDM-C duty holder and discharge coordination duties	2.867	3.000	1.187	57.34	10
RA7: Include provisions for domestic clients	2.800	3.000	1.014	56.02	11

Table 9.3: Evaluation of the proposed Change Drivers (CDrs)

Description	Mean	Median	Std Dev	RI	Rank
CD3: Management leadership	4.267	4.000	0.594	85.32	1
CD2: Proactive participation of duty holders in developing the H&S File	4.133	4.000	0.640	82.68	2
CD6: Industry/academic driven training to equip duty holders with sufficient knowledge on the benefits of early decision making involvement	4.133	4.000	0.640	82.68	2
CD7: Industry/academic driven training to equip duty holders with sufficient knowledge on provision of timely and adequate preconstruction information	4.067	4.000	0.704	81.34	3
CD8: Equip duty holders with sufficient knowledge on consequences of breaches/prosecutions and subsequent penalties (e.g. fines and imprisonment) through training and provisions within standard form contracts	4.067	4.000	0.799	81.32	4
CD4: Provide adequate resourcing throughout the (pre)construction phase	4.000	4.000	0.655	80.00	5
CD5: Industry/Academic driven training to equip main contractor with sufficient knowledge on discharging coordination duties	3.667	4.000	0.724	73.40	6
CD1: Equip duty holders with appropriate BIM competence	3.200	3.000	0.941	64.00	7

9.2 IMPLICATIONS FOR INDUSTRY

Despite the difficulty perceived in discharging some duties as discussed in Chapter 7, the results support the view that CDM stakeholders are willing to implement the majority of the remedial actions and change drivers. Given this observation, it is reasonable to argue that attainment of improved CDM implementation is plausible by undertaking appropriate remedial action. This is attainable if implementation of the remedial actions and change drivers is prioritised as established in the preceding section. It is envisaged that following such a strategy will ensure optimal discharge of duties, resulting in improved CDM implementation and H&S outcomes. Figure 9.1 depicts implementation of the remedial actions and change drivers, ordered in terms of priority according to the evaluation and the emerging significant correlations. The green arrows refer to a positive correlation, while the red arrow refers to a negative correlation. It is surprising that a negative correlation emerges between the remedial action for proactive collaboration (RA1) and the change driver for proactive participation of duty holders (CD2). Perhaps this outcome also reinforces the finding, which demonstrates the lack of interdependent working amongst duty holders. Notably, given the small number of participants who took part in the validation, there is need for more research to refine the remedial action framework and provide more clarity regarding its outcomes.

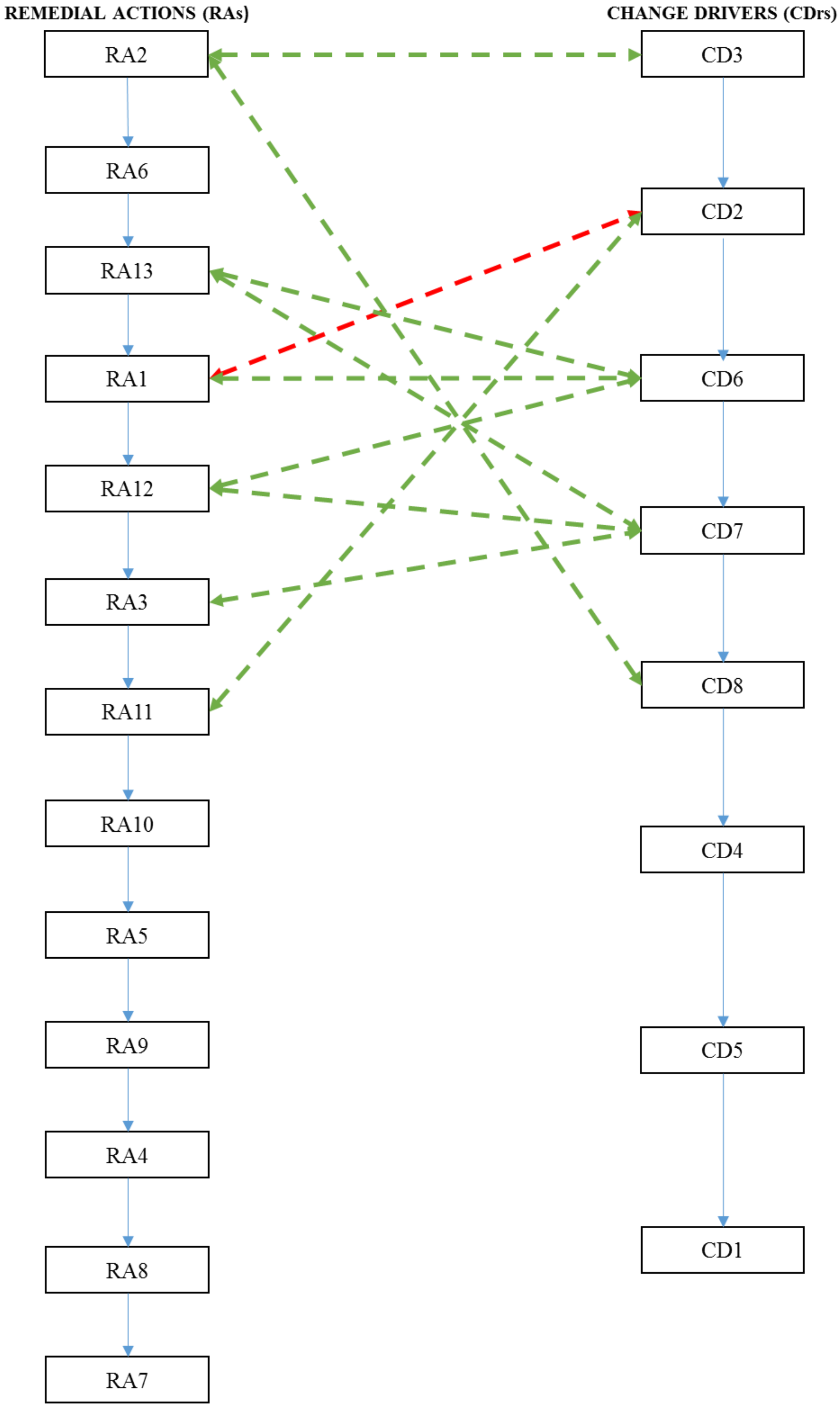

Figure 9.1: Ranking of the proposed RAs & CDrs (cf. Figure 8.3 and 8.4)

Furthermore, it is unequivocal that application of these remedial actions may trigger increased costs to equip duty holders with appropriate training. Moreover, despite promoting a heightened awareness of H&S issues because of the new regime (CDM 2015), there may still be uncertainties surrounding the practicalities of discharging duties, mostly during the early days. For example, Designers with experience of discharging CDM-C duties are likely to perform the PD role in-house, while other Designers may still rely on the input of an independent CDM-C or other CDM experts (see Section 9.3.2). This inevitably means that the Client may incur additional costs arising from services provided by other CDM stakeholders to remain complaint with the PD role. Unfortunately, what remains obvious is the likelihood of CDM stakeholders incurring additional costs to remain compliant with the CDM Regulations, although arguably, such costs maybe one-off in most instances rather than repetitive on each project.

9.3 IMPLICATIONS FOR FUTURE REFORM

Whilst this study is underpinned by the CDM 2007, Government came up with a new regime (i.e. CDM 2015) which came into force on 6 April 2015 as already noted in Chapter 4 (see Section 4.5). It is therefore imperative to compare the remedial action framework with the new regime. However, before doing so, the main changes in the CDM 2015 are reiterated.

The main changes introduced include: (a) removal of the ACoP and provision of guidance on the implementation of the CDM 2015; (b) replacing the ACoP; (c) removal of competence requirement; (d) replacing the CDM-C with the Principal Designer (PD); and (e) realigning the CDM Regulations with the TMCS Directive. Specific areas realigned to bear the resemblance of the TMCS Directive are: (i) removal of the competence requirement, (ii) inclusion of domestic clients; (iii) notification criteria of a project to the relevant authority; and (iv) appointment criteria of the PD and PC, where more than two contractors are present on a construction site (see Article 3(1)).

9.3.1 Replacing of the ACoP

In view of the shortcomings expressed in Chapter 4 regarding CDM implementation (see Section 4.4.2) and the recommendation in the Löfstedt report (see Löfstedt, 2011), the new regime replaces the ACoP with guidance on regulations (HSE, 2015). Although duty holders may not be found culpable based on the guidance, it is advisable that they adhere to such advice to remain compliant with the CDM Regulations. However, the remedial action framework recommends amending the ACoP rather than replacing it (i.e. RA10, RA11, RA12, and RA13). Notably, the remedial action to amend the ACoP to provide guidance on determining what resources are adequate for a particular project (RA13) is considered most important towards CDM implementation improvement. What remains critical is that the ACoP is a legal document unlike the guidance on regulations. Perhaps this questions whether simplifying enforcement of the new regime is beneficial to the CDM stakeholders.

9.3.2 Removal of competence requirement

Despite removing the requirement for competence, paragraph 35 of the guidance on regulations still recommends that duty holders should have the necessary skills, knowledge, and experience (HSE, 2015) to manage health and safety risks. Indeed, the remedial action framework suggests training of duty holders to equip them with the appropriate knowledge and skills (e.g. RA5, CD5). Moreover, it is undeniable that the new role of PD will require adequate training as elaborated in the next section.

9.3.3 Preconstruction phase coordination responsibilities

In the remedial action framework, it is proposed that the Main Contractor is best placed to discharge preconstruction phase coordination responsibilities (RA8). Against a background of an industry moving towards collaborative procurement routes and integrated project delivery, it was envisaged that this stakeholder is well placed to replace the CDM-C. Moreover, training is incorporated as a change driver to equip the Main Contractor with appropriate skills and knowledge (CD5) in the remedial action framework.

However, in the new regime, a new role is introduced known as the PD as previously established and considered suitable on the basis that a clear link can be established between design and preconstruction phase coordination (HSE, 2014c). Although, the evaluation of RA8 shows that it was considered unfeasible, it is questionable whether a Designer has the ability, knowledge, and appropriate skills to fully discharge preconstruction coordination responsibilities. Arguably, this outcome invites further research into identifying the suitability of a Designer to discharge preconstruction phase coordination responsibilities and the composition of such an organisation, given the likelihood to rely on the expertise of other CDM stakeholders.

Whilst this study found that the combined role of CDM-C and Contract Administrator was the most common (RI= 46.4), the proposed role of PD in the new regime is questionable, given that the combined role of CDM-C and Designer was ranked second (RI=44.2). Interestingly, it was found that the combined role of PC and Designer yielded a higher RI of 49.6, signalling that a Main Contractor is ideally placed to discharge preconstruction coordination responsibilities as argued previously.

9.3.4 Discharge of duties and resourcing

This study reveals that collaborative working amongst duty holders is a challenge as highlighted above. In view of this, it was observed that some duties are not always discharged. Perhaps this signals that there is need for concerted effort across the industry to remain fully complaint with the regulations. Moreover, this study found that some duty holders were inadequately resourced. In the new regime, it is expressed that the Client must provide sufficient time and resources (Regulation 4(1)) to ensure that duties are discharged sufficiently. This is consistent with the remedial action to provide proportionate resourcing to reflect specific risk assessment and competence requirements (RA3). Additionally, the misalignment revealed by this study between the extent of discharge of duties and the perceived degree of importance questions whether the deployment of resources to discharge duties is accurate or indeed adequate. To this end, duty holders in the new regime are expected to have appropriate knowledge, experience, and capability to secure the H&S of persons at construction sites (Regulation 8(1)).

9.3.5 Realigning the CDM Regulations with the TMCS Directive

A number of steps were taken to realign the CDM Regulations with the TMCS Directive. For example, the issue of domestic clients is one such new provision and requirement under the new regime (see Regulation 7). Despite proposing the inclusion of domestic clients as a remedial action (RA7) in the remedial action framework, its evaluation revealed that it was the least likely remedial action to improve CDM implementation. Perhaps this outcome is unsurprising given that most domestic clients are likely to be inexperienced, particularly during the early days. However, it is worth noting that all the duties applicable to a domestic client are transferred to other CDM stakeholders according to Regulation 7. Overall, this issue involving domestic clients' needs to be appraised critically by the HSE and other CDM stakeholders.

Furthermore, a project that involves two or more contractors, triggers the appointment of the PD and PC, and is considered notifiable where the construction work lasts longer than 30 days, or involves more than 20 workers simultaneously, or exceeds 500 person days. From the results of this study, it is observed that notification of the project was discharged frequently. As such, it did not trigger the need for any remedial action. Despite this finding, the new regime accurately realigns the CDM Regulations with the TMCS Directive in this regard.

9.3.6 Appointment stage of duty holders

It was revealed from this study that both the CDM-C and PC are typically appointed during the late stage of design. As such, it is of no coincidence, that the new regime provides more clarity in this regard. For example it stipulates that the PD and PC should preferably be appointed during the concept design stage or as soon as it is practical (Regulation 5(1)). Indeed, this offers an opportunity for early duty holder involvement and may trigger improved collaborative working, because as revealed from this study, duties that require interdependent working are discharged less frequently. This aspect of early appointment agrees with the remedial action to include provisions for the specific appointment stage of duty holders (RA6) and the change driver to train duty holders on the benefits of early involvement (CD6).

Notably, by realigning the appointment criteria to the TMCS Directive (Regulation 5(1)), it is questionable whether even small projects where two contractors are present, invite the appointment of a PD and PC. Indeed, this may be a matter of concern in terms of practicality, although arguably, where no such appointments are made, the Client assumes these roles by default (see Regulation 5(3) and 5(4)).

9.4 CHAPTER SUMMARY

This chapter reports findings from the validation of the remedial action framework. The evaluation of the remedial actions and change drivers, gave study participants an opportunity to determine the extent to which these actions and drivers are likely to improve CDM implementation as well as their feasibility and efficacy. The results indicate that it is both feasible and practical to implement the majority of the proposed remedial actions and change drivers, although there is need to prioritise their implementation. It is also reasonable to argue that provision of adequate resourcing and training at various levels to equip duty holders is central to achieve improved CDM implementation and H&S outcomes as observed from the statistically significant positive associations. The last chapter of the study draws conclusions, recommendations, and areas of further research.

CHAPTER 10: CONCLUSIONS, RECOMMENDATIONS AND AREAS FOR FURTHER RESEARCH

10.0 INTRODUCTION

The previous chapter presents results on the validation of the remedial action framework (*Wiin-CDM*). This chapter therefore draws conclusions, recommendations, and areas for further research based on the practical implementation of the CDM Regulations. Section 10.1 provides a review of the aim and objectives of the study in order to ascertain how they were achieved. In Section 10.2, a discussion on the main conclusions of the study is provided, while Section 10.3 sheds light on the study's contribution to knowledge. After discussing recommendations aimed at redressing the challenges of CDM implementation and areas that invite further research in Sections 10.4 and 10.5, Section 10.6 provides a discussion on the limitations of the study.

10.1 A REVIEW OF THE AIM AND OBJECTIVES OF STUDY

The study set out to critically examine the practical implementation of the CDM Regulations, identify practices and deficiencies regarding the extent of discharge of duties, and develop a framework for appropriate remedial action. To reiterate, achievement of the aim of the study required pursuit of the following objectives:

- critical review of literature pertaining to the state of H&S in the UK construction industry in order to establish its performance, improvement strategies and explore various accident causation theories;
- examination of the H&S legal framework in the UK construction industry in order to identify the underlying principles behind the primary H&S legislation and explore theories that underpin its enforcement;

- detailed analysis of the main provisions within the EU H&S Directives and determine the degree of alignment and shortcomings associated with CDM implementation;
- collection of primary data from key CDM stakeholders to examine the discharge of duties and identify practices and deficiencies associated with these obligations; and
- development and validation of a remedial action framework.

As such, achievement of these objectives required application of a coherent research design presented in Chapter 5. Table 10.1 provides a summary of the methods applied to achieve the research objectives set out.

Table 10.1: Achievement of the study objectives

Study objectives	Method(s) applied	Location
1. Critical review of literature pertaining to the state of H&S in the UK construction industry in order to establish its performance, improvement strategies, and explore various accident causation theories.	Literature review	Chapter 2
2. Examination of the H&S legal framework of the UK construction industry in order to identify the underlying principles behind the primary H&S legislation and explore theories that underpin its enforcement.	Literature review	Chapter 3
3. Detailed analysis of the main provisions within the EU H&S Directives and the CDM Regulations in order to determine the degree of alignment and shortcomings associated with CDM implementation.	Literature review	Chapter 4
4. Collection of primary data from key CDM stakeholders to examine the discharge of duties and identify practices and deficiencies associated with these obligations.	Primary data were collected from: (i) in-depth interviews and (ii) postal questionnaire surveys	Chapter 6 and Chapter 7
5. Development and validation of a remedial action framework (*Wiin-CDM*) towards improved CDM implementation.	Evaluation of the remedial actions and change drivers by study participants	Chapter 8 and Chapter 9

10.1.1 Literature review on the state of H&S in the UK construction industry

A critical review of literature shows that the state of H&S in the UK construction industry has tremendously improved over the past three decades. There is greater awareness of H&S issues, informed in part by the introduction of the CDM Regulations. However, despite this observation, fatalities still occur in the UK construction industry. The latest published statistics available from the HSE show this trend. Noticeably, the observed trend in the occurrence of accidents fluctuates, as such obscures the much sought after H&S improvement. Clearly, this is a source of concern given the various mechanisms put in place. Moreover, one such H&S improvement strategy that has a far-reaching impact is legislation, which in this case refers to the CDM Regulations given their relevance. Similarly, since shaping factors such as design specifications influence accident causation, stakeholder involvement is critical is this respect, which resonates with the CDM Regulations, given that they place specific obligations on various parties. It is therefore argued from the literature that the regulatory regime plays a critical role to attain H&S performance improvement.

10.1.2 Literature review on the H&S legal framework in the UK construction industry

A robust and thorough review of the literature relating to the H&S legal framework in the UK construction industry shows that the primary legislation originates from the Robens report. It adopts a self-regulating style, rather than one that is prescriptive. Thus, while undertaking research related to some form of legislation, it is often imperative to establish the primary authority of the legal framework.

As such, having established the origins of the primary legislation, an overview of the roles of the HSE to enforce such legislation is discussed and shows that the HSE play an important role in as far as enforcement is concerned. Additionally, secondary legislation relevant to the UK construction industry is identified which then succinctly introduces the CDM Regulations and their location within the H&S legal framework.

It is clear from Chapter 3 that the CDM Regulations are best placed to address H&S concerns from a legal perspective given the shared responsibility ethos.

10.1.3 Literature review on the main provisions within the TMCS Directive and the CDM Regulations

A process involving four steps achieves the third objective of the study. First, it introduces the issue of management of risk and identifies the salient issues that inform this concept. Second, it then discusses the principles behind the Council Directives (i.e. the Framework and TMCS Directives). Further, provisions within the Directives are analysed to establish the degree of alignment and transposition in the UK construction industry. Third, the CDM Regulations are introduced, providing a discussion on their original format as CDM 1994 and what led to their revocation. This leads to a discussion on the CDM 2007 of which duty holder responsibilities are identified and challenges associated with the overall implementation of the CDM 2007 are discussed. Fourthly, a brief discussion on the new regime (CDM 2015) is presented and the main requirements in support of CDM implementation are discussed.

10.1.4 Practices and deficiencies associated with the discharge of duties of the Designer

Having undertaken in-depth interviews with design organisations appointed in the role of the Designer, current practices associated with the discharge of the Designer's duties in the context of the CDM 2007 are revealed. By applying thematic analysis and categorising the transcribed verbatim interview details into these themes and duties, the study highlights a number of practices associated with the discharge of the Designer's duties. Most notably, it was commonplace for Designers to insert notes on drawings regarding unusual hazards and sometimes, they delegated the responsibility to provide design sufficient information to other experts. Although the interviewees were largely conversant with their duties under the CDM 2007, the discharge of these duties varied. They were influenced by the terms of engagement provided by the Client, the project complexity and the input received from other duty holders. It was also found that securing the input of an independently appointed CDM-C was difficult. It is against such a background that some Designers preferred to discharge the role the CDM-C.

10.1.5 Practices and deficiencies associated with the discharge of duties of the CDM-C and PC

The primary data captured in the two surveys undertaken targeting duty holders appointed in the roles of CDM-C and PC reveal differences in the discharge of duties. It was found that some duties are more difficult to discharge than other duties, although this did not significantly hinder their discharge.

The results further revealed that the CDM-C is typically appointed during the late stage of design while the PC is appointed during the construction stage. Additionally, it is revealed that the extent of discharge of duties differs, owing to their perceived degree of importance and difficulty of duties. 50% (5 of 10) of the duties of the CDM-C are misaligned in terms of extent of discharge and perceived degree of importance, while 25% (5 of 20) of the duties of the PC are also misaligned. This failure to reflect criticality of duties in their discharge could have implications for improved H&S performance outcomes. It perhaps also signals a lack of understanding the consequences of breaches and prosecutions.

A comparison between extent of discharge of duties and their perceived degree of difficulty revealed that all the duties of the PC are statistically significant, meaning that the perceived degree of difficulty does not hinder their extent of discharge. While 90% of the

CDM-C duties are also statistically significant, this again implies that the perceived degree of difficulty of duties does not impede their discharge. In other words, the difficulty associated with the discharge of duties performed by the CDM-C and PC does not necessarily reflect the extent of discharge of duties.

Furthermore, the results confirm that collaboration is still a challenge amongst duty holders, demonstrated by the PC duty to liaise with the CDM-C and Designer (Regulation 22(1)(b)) and the CDM-C duty to ensure Designers comply with their duties (Regulation 20(2)(c)); and the Designer's duty to ensure appointment of the CDM-C (Regulation 18(1)). The three duties of the CDM-C perceived most difficult to discharge are:

- ensuring Designers comply with their duties (Regulation 20(2)(c));
- preparing the H&S File (Regulation 20(2)(e)); and
- liaising with the PC regarding information required for preparation of the construction phase plan (Regulation 20(1)(c)).

As for the PC, the three duties perceived most difficult, include:

- ensuring each contractor provides construction activity information (Regulation 22(1)(j));
- liaising with the CDM-C and the Designer (Regulation 22(1)(b)); and
- consulting contractors before finalising the construction phase plan (Regulation 22(1)(g)).

From the duties mentioned above, it can be observed that interdependent working is a challenge in practice during the implementation of the CDM Regulations. It is for this reason that collaboration, accountability and compliance, and facilitation are conceived as themes informing the remedial action framework.

10.1.6 The framework for remedial action

In order to address the discrepancies associated with the discharge of duties and their misalignment with the TMCS Directive, developing a framework for remedial action was imperative. It was paramount to take cognizance of the provisions within TMCS Directive given that this Directive underpins the CDM Regulations. This provided clarity regarding their transposition in the UK construction industry. The findings show that there is some misalignment between the CDM Regulations and the TMCS Directive. To this end, a critical analysis of these provisions in line with the study's findings yields a framework encompassing corrective actions and drivers complementing those remedial actions. Additionally, the developed framework is also partly informed by the recurring changes considered feasible, discussed in Chapter 8 (see Section 8.3).

The validation of the framework ranks the remedial actions and drivers in terms of priority to implement them. It is clear from the rankings that management leadership is a critical change driver to achieve the remedial actions. The other most important drivers are proactive participation of duty holders and training to equip duty holders with sufficient knowledge on the benefits of early decision-making involvement. As such, implementation of the '*Wiin-CDM*' framework is considered plausible (see Section 9.1.1).

10.2 CONCLUSIONS

This study commenced before Government plans to revise the CDM 2007 as such considered timely and topical. Moreover, the underlying principles of CDM implementation largely remain unchanged. Given this insight, it is envisaged that findings from this study provide an opportunity to scrutinise the new regime (CDM 2015), particularly regarding the new role of Principal Designer (PD) and other additional provisions and amendments.

After critical analyses of data, various patterns emerge regarding CDM implementation. Initially, an inspection of the central tendency scores reveals variances pertaining to the extent of discharge of duties and their perceived degree of importance and difficulty. As for duties of the Designer, some practices were common, while others are different. This section presents a thorough discussion of various issues that emerge from the results, and draws the main conclusions.

10.2.1 Appointment stage of CDM duty holders

The results show that there is a tendency to appoint the CDM-C and PC during the late stages of design. Typically, the CDM-C is appointed during the 'technical design stage' while the PC is appointed during the 'construction stage' (see Section 7.3). The study also confirms that the appointment stage has an influence on the subsequent discharge of duties, given the insignificant association with the earlier stages of appointment, which signals the insufficient input received from both the CDM-Cs and PCs during the early stages of design. This failure regarding lack of early appointment further reduces the time required for CDM mobilisation. As such, the proposed remedial action regarding early appointment is perceived as likely to improve CDM implementation, while the corresponding change driver is considered feasible to implement within duty holder organisations.

10.2.2 Discharge of duties by the Designer

The results showed that there are some standard practices concerning the discharge of duties of the Designer, while some practices were nonstandard. To design out risk, it was common for the Designer to address the unusual ones rather than obvious ones, which a competent contractor had the ability to identify and address. In such circumstances, the Designer provided information regarding the unusual hazards and delegated the responsibility to another project team member with the appropriate expertise (see Section

6.2). The results pertaining to the Designer also show that working interdependently is still a challenge, particularly with an independently appointed CDM-C.

Whilst it is critical for Designers to ensure that the designs produced are explicit enough to be understood by the PC and other project stakeholders, Designers were of the view that aesthetics were of equal importance to set precedence for subsequent designs. From the practices associated with the discharge of their duties, it was largely observed that securing the input of an independently appointed CDM-C proved difficult. Perhaps, it can be argued that such a background reinforces the practice of Designers discharging CDM-C duties. However, this study proposes that the Main Contractor is better placed to replace the CDM-C, given that the industry is moving towards collaborative procurement routes as reiterated in Section 10.2.7.

10.2.3 Discharge of duties by the CDM-C

The findings reveal that there are variations in the discharge of duties across the industry and in terms of the discharge of each individual duty (see Section 7.4.1). These variations are also notable regarding the perceived degree of importance and difficulty of duties. Unsurprisingly, duties regarded as most difficult involved collaborating with other duty holders. An example of such a duty in the case of the CDM-C is ensuring Designers complied with their duties (Regulation 20(2)(c)). It was also observed that the majority of the duties of the CDM-C were not always discharged. Despite this outcome, it was surprising to note that the perceived degree of difficulty did not hinder the discharge of 90% of the duties. As for duty related to preparation of the H&S File (Regulation 20(2)(e)), it was found to be difficult, yet perceived important and discharged often. Since preparation of the H&S File requires the input of others, this confirms the challenge faced by the CDM-C when securing cooperation from other duty holders.

Further, it was found that 50% (5 of 10) of the duties of the CDM-C were misaligned in terms of their extent of discharge and perceived degree of importance. As such, it is unsurprising that there was little correlation between the extent of discharge of duties and the perceived degree of importance. Considering the need to prioritise resources, lack of such a distinction between critical and less critical duties could have implications for desirable H&S outcomes.

10.2.4 Discharge of duties by the PC

The extent of discharge of duties regarding the role of the PC generally varied. Only 30% of the duties are typically always discharged (6 of 20). Similar to the duties of the CDM-C, it was found that the duties perceived most difficult involved working collaboratively with other duty holders. For example, liaising with other duty holders (e.g. Regulations 22(1)(j), 22(1)(b) and 22(1)(g)) are the most difficult. However, this perceived degree of difficulty did not impede the extent of discharge across all the duties, also indicating the willingness of PCs to remain compliant with their duties (see Section 7.7.2).

On the other hand, five duties (25%) are misaligned in terms of their extent of discharge and the perceived degree of importance. Again, this failure to identify criticality of duties may have an impact on the overall H&S management given the need for accurate deployment and prioritising of resources as explained in Section 10.2.5. The associations between the extent of discharge of duties and the perceived degree of difficulty showed an inverse direction. This means that an increase in the extent of discharge relates to a decrease in the perceived degree of difficulty, thus confirming the earlier finding regarding difficulty of duties. There are also statistically significant associations between the extent of discharge of duties and the perceived degree of importance. However, strength of the majority of these correlations is weak. The duties relating to the Construction Phase Plan are discharged frequently, while generally perceived important (see Sections 7.4.2 and 7.6.2) and largely perceived as easy to discharge.

10.2.5 Resourcing required to perform the CDM duty holder role

The results indicate that some duty holders are inadequately resourced to perform their roles. Typically, over 30% of the CDM-Cs and PCs were inadequately resourced, which questions their ability to discharge duties sufficiently. As for dual appointments, the combination of CDM-C and Designer was the most common, whereas the PC and Main Contractor combination was also the most common, confirming that in most instances the Main Contractor is largely appointed as PC, as observed from the reviewed literature. Indeed, it can even be argued that, adequate resourcing facilitates improved accountability and compliance with the CDM Regulations.

10.2.6 Realignment of the CDM Regulations with the TMCS Directive

A comparison between the provisions of TMCS Directive and those transposed in the CDM 2007 shows some salient differences. Most notably, the notification of a project criterion is different. The number of contractors on site triggers appointment of coordinators under the TMCS Directive (Article 3(1)), whereas a project over 30 days or involving 500 person days, considered notifiable, triggers appointment of the CDM-C and PC under the CDM 2007 (see Regulations 2(3) and 14). Whereas, notice in the TMCS Directive is given when work is scheduled to last longer than 30 working days or involving more than 20 workers (Article 3(3)). Other differences include the competence requirement (Regulation 4) and duties of the Designer, which are not explicitly expressed in the TMCS Directive. Arguably, these differences may not drastically influence improved CDM implementation, apart from the competence requirement, which is perceived to be one of the sources of unnecessary paperwork (see Section 4.3.2).

10.2.7 The proposed remedial action framework

The validation of the *Wiin-CDM* framework reveals the order of priority in terms of their implementation. Notably, the remedial actions and change drivers are categorised according to their perceived influence stage. For example, proactive collaboration of duty holders is considered to have a direct influence on improved CDM implementation, whereas, ensuring adequate arrangements for coordination of H&S measures during planning and preparation for the construction phase is perceived to be influential at the organisational level.

Further, a comparison between the *Wiin-CDM* and the new regime (CDM 2015) reveals significant differences at the same time similarities. Rather than removing the ACoP completely, there is need to amend its provisions given its importance as a guide, advocated for by this study to avoid under implementation and where appropriate, provide guidance for additional provisions. This study also provides explicit corrective steps such as training to equip duty holders with sufficient knowledge as well as encouraging their proactive participation in a concerted manner. Whilst it was suggested that there was need to incorporate duties of the domestic Clients, the validation of the *Wiin-CDM* shows that it is the least important and therefore the HSE needs to revisit this issue (see Section 8.2).

10.3 CONTRIBUTION TO KNOWLEDGE

This research extends the current understanding and knowledge regarding the practical implementation of the CDM Regulations, specifically drawing insight from the extent of discharge of duties, the perceived degree of importance of duties, and the perceived degree of difficulty of duties. The variations observed regarding the extent of discharge of duties pertaining to the various duty holders (i.e. the Designer, CDM-C, and PC), largely emanate from a lack of cooperation amongst these duty holders, signalling that there is still considerable scope for improved CDM implementation. Based on these outcomes, a remedial action framework is developed with the prime intention of redressing the CDM implementation challenges. From the evaluation of the proposed remedial actions and change drivers, it is revealed that the majority of the remedial actions and change drivers are considered likely to influence the practical implementation of CDM Regulations towards improved H&S management.

Overall, it is reasonable to conclude that the study extends the current understanding and knowledge regarding the practical implementation of the CDM Regulations. It is revealed that duties requiring interdependent working are less frequently discharged than duties discharged independently. This signals that there are collaborative challenges and apathy towards the discharge of some duties. Further, the evidence shows that there is a misalignment between the extent of discharge of duties and the perceived degree of importance. This outcome may result in failure to deploy resources more accurately for the optimal discharge of duties, which undoubtedly supports the view that there is still considerable scope for improved CDM implementation.

Whist previous studies have attempted to address CDM implementation challenges (e.g. Dalby, 2009; SEC, 2010; ICE, 2011; Frontline Consultants 2012a); they mainly describe various shortcomings and do not provide a detailed account of the extent of discharge of specific duties and perceived degrees of importance and difficulty of duties across the construction industry.

10.3.1 Appointment stage of duty holders

Despite the importance attached to early appointment, the results reveal that duty holders are typically appointed during the late stages of design. Indeed, it is no coincidence that late appointments influence the discharge of subsequent tasks. For example, although provision of adequate preconstruction information is typically discharged often as shown from the evidence, its impact on the successive discharge of other duties is obvious. Clearly, the appointment stage not only influences the timely discharge of duties, but also influences the subsequent discharge of other duties. This study therefore contributes to knowledge by identifying the specific appointment stage of CDM-Cs and the PCs and recommends early appointment as a remedial action. Notably, the correlation between the extent of discharge of duties and the appointment stage yields a negative (or inverse) result during the early stages and changes to positive (direct) in the latter stages. Although not causal, this signals that duty holders are typically appointed late. As such, to trigger early appointment, a tool such as BIM not only provides a platform for early collaboration, but also may reduce the amount of paperwork. However, the evaluation shows that BIM is largely considered unfeasible to improve CDM implementation, perhaps because of the likely cost to be incurred in training personnel and procurement of appropriate equipment.

10.3.2 Ranking CDM duties according to their extent of discharge

The ranking of duties performed by CDM-Cs and PCs according to their extent of discharge shows a noticeable pattern. It is observed that duties associated with collaborative working are less frequently discharged than other duties. Perhaps this confirms the symptomatic and sometimes fragmented nature of the construction industry, against a backdrop of limited resources such as time and money; and a continuously evolving project team. In addition, given the subcontracting nature of construction procurement within its supply chain (BIS, 2013b); it is critical that early duty holder appointment and collaboration is sought as proposed in the remedial action framework (*Wiin-CDM*).

10.3.3 Ranking CDM duties according to their perceived degree of importance

The perceived degree of importance of duties to contribute towards improved H&S management varies. This may not be so surprising, typical of an industry that attempts to make the best use of limited resources at an opportune time. Indeed, it is imperative for the industry to establish CDM duties that are more critical in order to prioritise resources. This study demonstrates this issue, thus contributes to knowledge towards improved H&S management, exceeding the current understanding of CDM implementation. When established that a duty is perceived unimportant and misaligned with the TMCS Directive, it is reasonable for such a duty to be jettisoned or at least extensively revised as demonstrated in the remedial action framework (*Wiin-CDM*).

10.3.4 Ranking CDM duties according to their perceived degree of difficulty

Similar to the perceived degree of importance, ranking duties in terms of their perceived degree of difficulty to discharge them, yields variations. This signals that some duties are perceived easier to discharge, while others are perceived more difficult. If a duty is perceived unimportant yet difficult to discharge, it invites further scrutiny, to establish whether: (a) it conforms to the TMCS Directive; and (b) requires consideration as a candidate for reform. This study demonstrates that it is viable to adopt such a strategy to review extensively the practical implementation of the CDM Regulations, when considering reforms. It therefore provides an alternative strategy for introducing a new regime, thus complementing views from practitioners, which may be broad and wide-ranging. Moreover, given that over 40% of the duties of the CDM-C are perceived difficult, compared to 10% of the PC duties, it is questionable whether the CDM-C duty holder is fit for purpose. However, it is reasonable to argue that lack of interdependent working and limited resources influence the perceived degree of difficulty of duties.

10.3.5 Resourcing required to perform CDM duties

The main intention of this section was to identify what is considered as adequate resourcing to perform various CDM duties. During the preconstruction phase, it was typically found that less than 10 man-days are required to discharge duties of the CDM-C, while less than one-man day per-week is required during the construction phase at a cost of £301-£400 per man-day. This study confirms the lack of adequate involvement of the CDM-C.

As for resourcing of the PC, it was found that 11-20 man-days are typically required during the preconstruction phase and 5 man-days during the construction phase per week at a cost of £201-£300 per man-day. Although it can be inferred that discharging the PC duties required more resourcing in terms of man-days, it was less costly when compared to the CDM-C man-day. This study demonstrates that the resourcing required to discharge duties not only needs to be adequate, but also proportional to complexity of project. It therefore makes a significant contribution to knowledge by proposing appropriate remedial actions and corresponding change drivers.

10.4 RECOMMENDATIONS TO INDUSTRY

The results support the view that there is still considerable scope for CDM implementation improvement, particularly regarding the practical discharge of duties. It is clear that collaborative working amongst duty holders requires an extensive concerted effort to encourage timely participation and optimal discharge of duties. Given that the industry is moving towards collaborative procurement routes and integrated project delivery, it was predicted that the Main Contractor is best placed to discharge coordination responsibilities. However, from the evaluation of the *Wiin-CDM*, the results indicate that this duty holder was considered unfavourable. This is surprising given that even the HSE (2014d) also support the view that an existing duty holder is better placed to discharge preconstruction phase coordination responsibilities. Moreover, the finding regarding lack of collaborative working amongst duty holders is a significant outcome of this study and should not to be taken lightly. More so, provisions for cooperation amongst duty holders are expressed explicitly within the CDM Regulations (e.g. Regulation 5). Overall, it is considered that training to equip duty holders with the appropriate skill set, adequate resourcing and instil a sense of collaborative working are central. For example, upskilling in preconstruction coordination duties is critical. As such, there is need for further research exploring other potential tools likely to trigger proactive participation of duty holders as elaborated in Section 10.5.

Considering the discussion in the preceding paragraph, it is recommended that the industry should:

- implement the proposed remedial actions and change drivers in the order of priority (see Tables 9.1 and 9.2);
- ensure that a project team member discharges preconstruction coordination responsibilities, as such realigning with the TMCS Directive provisions;
- provide training that corresponds to the proposed changes;
- provide proportionate resourcing to reflect risks specific to a particular project or task;
- the HSE should consider amending the ACoP to provide appropriate guidance on the various issues that impede improved CDM implementation such as early duty holder appointment; and
- the HSE should consider providing guidance on collaborative working amongst duty holders; and

- the HSE should consider consulting various industry stakeholders such as the CITB regarding industry training needs in the context of CDM implementation.

10.5 RECOMMENDATIONS TO RESEARCHERS AND AREAS FOR FURTHER RESEARCH

The study reveals a misalignment between the extent of discharge of duties and the perceived degree of importance. This implies that there is failure to realise the criticality of duties towards improved H&S management. Against a backdrop of the need to prioritise deployment of resources, the lack of such a distinction impedes improved H&S management outcomes. However, more work is required to develop extensively the remedial action framework, in order to determine its degree of efficacy. Moreover, there is still more work required to establish the extent of discharge of duties by the Client, Contractors, and the self-employed workers.

Therefore, this study is of benefit not only to the construction industry, but also to other researchers given that it provides significant insight into the practical implementation of the CDM Regulations particularly regarding the roles of the Designer, CDM-C, and PC. As such, improvement of CDM implementation would benefit from further research to:

- investigate the impact of changes to the CDM Regulations, particularly on an organisation's operations in terms of cost and efficacy;
- determine the specific resources required to discharge a duty proportionally, thus capturing issues such as resource allocation and implementation. As this study has shown, there are discrepancies regarding the extent of discharge of duties and therefore there is need to explore this issue further by conducting qualitative research, utilising a Delphi technique or utilising live projects as units of analysis;

- examine critically the extent to which the discharge of duties meets the expectations of the other duty holders to establish the degree of satisfaction;
- further investigate the barriers and enablers towards duty holder collaboration;
- undertake an in-depth analysis of prosecutions, particularly in relation to individual CDM duties. It anticipated that such a study might provide an opportunity to identify duties that are breached frequently, and establish recurring themes. To compliment this method, an action research, which is preferably longitudinal, can prove useful, thus analysing how enforcement is undertaken by the HSE in practice.

10.6 LIMITATIONS OF THE STUDY

As expressed above, the study would have benefited from critically analysing the extent of discharge of duties of the Clients, Contractors, and self-employed workers. Although it was qualified that this study targeted the non-traditional roles, it is useful to reiterate that time and other resources were the main hindrances. In other words, analysing duties of the Clients, Contractors and self-employed workers in terms their degree of alignment with the TMCS Directive would have been advantageous. The other limitation of the study was the number of interviews conducted, although it is arguable that a saturation point was achieved, signalling that conducting further interviews would have been of no benefit, thus yielding informational redundancy. Despite this view, Designers are widely defined in the context of the CDM Regulations; as such developing an accurate sampling frame was impractical.

In addition, validation of the remedial action framework by other respondents would have also enhanced the evaluation of the remedial actions and change drivers, thus considered as a limitation of this study. Moreover, the study would have also benefited from undertaking follow-up interviews with the survey respondents, primarily addressing how they discharged their duties on live projects. Furthermore, the study did not utilise court judgements due to the inaccessibility of such deliberations from the magistrates' courts, thus also viewed as a limitation and perhaps an area for further research.

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APPENDICES

APPENDIX – 1 (TYPICAL COVER LETTER ACCOMPANYING QUESTIONNAIRE SURVEY)

UNIVERSITY OF WOLVERHAMPTON

[Date]

[Address]

Dear [Name],

INVITATION TO PARTICIPATE IN CDM REGULATIONS RESEARCH

I am carrying out research towards the award of a PhD by the University of Wolverhampton. The aim of the research is to examine critically the implementation of the CDM Regulations and to produce a framework for improvement action. In order to achieve this aim, input from organisations and individual practitioners like yours or yourself is required. I would therefore be most grateful for your participation by completing the attached questionnaire and returning it in the self-addressed enclosed envelope (NO STAMP REQUIRED) preferably before 18th October 2013. As a token of appreciation, findings of the research will be sent to you at no cost.

Given that the research problem is practice-based, it is envisaged that on-going or recently completed projects as well as your overall experience will provide strong insights into the nature of the problem identified. The information provided will be used for research purposes only and not otherwise without your express permission. In this regard, you are assured that data collected will be anonymised in the thesis whilst original information provided will be kept STRICTLY CONFIDENTIAL and destroyed upon completion of the study. The research is being conducted under the supervision of Professor Issaka Ndekugri, Dr Nii Ankrah, and Dr Felix Hammond of the University of Wolverhampton.

It is expected that the research outcomes will be useful for the construction industry at large, particularly policy makers, practitioners and researchers. It is likely that the research will highlight specific areas of the CDM Regulations that may require review based on their practical implementation considerations. This research may therefore have some relevance to the current review of the CDM 2007 although that is not the purpose of this study.

If you have any questions regarding the research, or would like additional information to assist you in reaching a decision about participation, please do not hesitate to contact the undersigned.

Yours faithfully,

D Mzyece BSc MSc
Faculty of Science and Engineering, University of Wolverhampton
Wulfruna Street, Wolverhampton, WV1 1LY
Email: d.mzyece@wlv.ac.uk
Telephone: +44(0) 1902321421

APPENDIX - 2 (QUESTIONNAIRE SURVEY – CDM COORDINATOR)

AN INVESTIGATION INTO THE IMPLEMENTATION OF THE CDM REGULATIONS IN THE CONSTRUCTION INDUSTRY

Preamble

The aim of the research is to examine critically the implementation of the CDM Regulations and to produce a framework for improvement action. The attached questionnaire comprises of nine sections and will take approximately 25 minutes to complete. All questions can be answered by following the simple instructions provided. There are no "correct" or "incorrect" answers and even if a question is not clear, try and respond to the best of your knowledge. If you wish to obtain a copy of the research results, please provide your contact details. Please note that all data gathered for this study will only be accessible by the research team; stored securely and destroyed upon completion of the study.

If you have any questions, please do not hesitate to contact D. Mzyece on email: d.mzyece@wlv.ac.uk

Section 1.0 Professional background information			
1. Which of the following best describes your position? (Please tick[✓] one box only)			
Director❑	Senior CDM Coordinator❑	CDM Coordinator❑	Other❑ (Please specify):_______________ _______________

2. How many years of experience do you have in this position? Please specify_______________________________________
3. How many years of experience do you have in the construction industry in total? Please specify____________________
4. What is your professional background/expertise (e.g. Architect, Quantity Surveyor, Engineer)? Please specify:____ _____________
5. Are you a member of any professional institution (e.g. APS, IOSH, RICS, CIOB)? Yes ❑ No ❑ If "yes", please specify the institution(s) and type(s) of membership:____

6. Contact details (Optional)

Name:	
Address:	
Telephone & Email:	

Section 2.0 Appointment as CDM Coordinator						
Please attempt all questions by ticking [✓] in the appropriate box. ***The rating scale is as follows: 5 = 'highly likely', 4 = 'likely', 3= 'even', 2 = 'unlikely' and 1= 'highly unlikely'***						
1.	**Based on your experience, when is the CDM Coordinator likely to be appointed on the project:**	***Highly likely***				***Highly unlikely***
		5	4	3	2	1
a.	Preparation and brief stage					
b.	Concept design stage					
c.	Developed design stage					
d.	Technical design stage					
e.	Construction stage					
Other:						
2.	**To what extent is the timing of the CDM Coordinator appointment likely to affect the following practices:**	***Highly likely***				***Highly unlikely***
		5	4	3	2	1
a.	Notification of the project to the HSE (or the ORR)					
b.	Provision of sufficient advice to the Client					
c.	Facilitation of coordination with regards to health and safety measures					
d.	Liaison with the Principal Contractor during the preparation of the Construction Phase Plan					
e.	Facilitation of cooperation and coordination between duty holders					
f.	Development of the Health and Safety File					

Section 3.0 Extent to which duties of the CDM Coordinator are discharged in practice						
Please tick [✓] in the appropriate box. ***The rating scale is as follows: 5 = 'always', 4 = 'often', 3= 'sometimes', 2 = 'rarely' and 1= 'never'***						
1.	**To what extent are the following duties of the CDM Coordinator discharged in practice:**	*Always*				*Never*
		5	4	3	2	1
a.	Give suitable advice and assistance to the client regarding compliance with the clients' duties under the Regulations.					
b.	Ensure that arrangements for coordination of health and safety measures					

Section 3.0 Extent to which duties of the CDM Coordinator are discharged in practice						
Please tick [✓] in the appropriate box. ***The rating scale is as follows: 5 = 'always', 4 = 'often', 3= 'sometimes', 2 = 'rarely' and 1= 'never'***						
1.	**To what extent are the following duties of the CDM Coordinator discharged in practice:**	*Always*				*Never*
		5	4	3	2	1
	during planning and preparation for the construction phase are implemented.					
c.	Take reasonable steps towards identifying and collecting pre-construction information.					
d.	Promptly provide pre-construction information to all designers, contractors and the Principal Contractor.					
e.	Ensure notice is given to the Health and Safety Executive (or Office of Rail Regulation).					
f.	Liaise with the Principal Contractor regarding information required for the preparation of the Construction Phase plan, contents of the Health and Safety File and any design development that may affect the planning and management of construction work.					
g.	Take all reasonable steps to ensure designers comply with their duties and provide sufficient information about aspects of the design to assist other designers, clients, the CDM Coordinator, and contractors.					
h.	Take all reasonable steps during the construction phase to ensure cooperation between designers and the Principal Contractor in relation to any design or design change.					
i.	Prepare where none exists the Health and Safety File and update/review for subsequent construction work.					
j.	Handover the Health and Safety File to the client at the end of the construction phase.					
Other:						

Section 4.0 Extent to which duties of the CDM Coordinator are burdensome in practice						
Please tick [✓] in the appropriate box. *The rating scale is as follows: 5 = 'most burdensome', 4 = 'burdensome', 3= 'even', 2 = 'somehow burdensome' and 1= 'least burdensome'*						
1.	To what extent are the following duties of the CDM Coordinator burdensome to discharge in terms of the administrative work or organisational effort involved which as a result generates excessive paperwork:	***Most burdensome***				***Least burdensome***
		5	4	3	2	1
a.	Give suitable advice and assistance to the client regarding compliance with the clients' duties under the Regulations.					
b.	Ensure that arrangements for coordination of health and safety measures during planning and preparation for the construction phase are implemented.					
c.	Take reasonable steps towards identifying and collecting pre-construction information.					
d.	Promptly provide pre-construction information to all designers, contractors and the Principal Contractor.					
e.	Ensure notice is given to the HSE (or Office of Rail Regulation).					
f.	Liaise with the Principal Contractor regarding information required for the preparation of the Construction Phase plan, contents of the Health and Safety File and any design development that may affect the planning and management of construction work.					
g.	Take all reasonable steps to ensure designers comply with their duties and provide sufficient information about aspects of the design to assist other designers, clients, the CDM Coordinator, and contractors.					
h.	Take all reasonable steps during the construction phase to ensure cooperation between designers and the Principal Contractor in relation to any design or design change.					
i.	Prepare where none exists the Health and Safety File and update/review for subsequent construction work.					
j.	Handover the H&S File to the client at the end of the construction phase.					
Other:						

Section 5.0 Importance of the CDM Coordinator duties						
Please tick [✓] in the appropriate box. *The rating scale is as follows: 5 = 'most important', 4 = 'important', 3= 'even', 2 = 'less important' and 1= 'least important'*						
1.	To what extent are the following duties of the CDM coordinator important in terms of actual positive impact on health and safety:	*Most important*			*Least important*	
		5	4	3	2	1
a.	Give suitable advice and assistance to the client regarding compliance with the clients' duties under the Regulations.					
b.	Ensure that arrangements for coordination of health and safety measures during planning and preparation for the construction phase are implemented.					
c.	Take reasonable steps towards identifying and collecting pre-construction information.					
d.	Promptly provide pre-construction information to all designers, contractors and the Principal Contractor.					
e.	Ensure notice is given to the Health and Safety Executive (or Office of Rail Regulation).					
f.	Liaise with the Principal Contractor regarding information required for the preparation of the Construction Phase plan, contents of the Health and Safety File and any design development that may affect the planning and management of construction work.					
g.	Take all reasonable steps to ensure designers comply with their duties and provide sufficient information about aspects of the design to assist other designers, clients, the CDM Coordinator, and contractors.					
h	Take all reasonable steps during the construction phase to ensure cooperation between designers and the Principal Contractor in relation to any design or design change.					
i.	Prepare where none exists the H&S File and update/review for subsequent construction work.					
j.	Handover the H&S File to the client at the end of the construction phase.					
Other:						

Section 6.0 CDM Duty holder role(s) undertaken in practice						
Tick [✓] in the appropriate box. ***The rating scale is as follows: 5 = 'always', 4 = often', 3= 'sometimes', 2 = 'rarely' and 1= 'never'***						
1.	**Please rate the following statements as accurately as possible based on your experience:**	***Always***				***Never***
		5	4	3	2	1
a.	I am usually provided with enough resources to perform my role as CDM Coordinator					
b.	I (or my organisation) take/s on the combined roles of CDM Coordinator and Client					
c.	I (or my organisation) take/s on the combined roles of CDM Coordinator and Principal Contractor					
d.	I (or my organisation) take/s on the combined roles of CDM Coordinator and Designer					
e.	I (or my organisation) take/s on the combined roles of CDM Coordinator and Main Contractor under the contract					
f.	I (or my organisation) take/s on the combined roles of CDM Coordinator and Contract Administrator					
Other:						

Section 7.0: Resourcing of the CDM Coordinator role		
Tick [✓] in the appropriate box		
1. Please specify the resourcing required to adequately perform the role of CDM Coordinator during the pre-construction planning phase:		
a.	Less than 10 man days	❑
b.	11 – 20 man days	❑
c.	21 – 30 man days	❑
d.	31 – 40 man days	❑
e.	41 – 50 man days	❑
f.	Other	❑
If other, please provide details:		

Section 7.0: Resourcing of the CDM Coordinator role (Continued)		
Tick [✓] in the appropriate box		
2. Please specify the resourcing required to adequately perform the role of CDM Coordinator during the construction phase:		
a.	Less than 1 man day per week	❑
b.	2 man days per week	❑
c.	3 man days per week	❑
d.	4 man days per week	❑
e	5 man days per week	❑
f.	Other	❑
If other, please provide details:		
3. Please specify the cost of a man-day of the CDM Coordinator:		
a	Less than £200	❑
b	£201 – £300	❑
c	£301 – £400	❑
d	£401 – £500	❑
e	£501 - £600	❑
f	More than £600	❑

Section 8.0 Changes to the CDM Regulations
Please comment on the following:
1. The most important change I would like to see in the CDM Regulations is:
2. The most important change I would like to see in the role of the CDM Coordinator is:

Section 8.0 Changes to the CDM Regulations (Continued)
Please comment on the following:
3. The most important change I would like to see in the role of the Principal Contractor is:
4. The most important change I would like to see in the CDM role of the Designer is:
5. The most important change I would like to see in the CDM role of the Client is:

Section 9.0 General information
1. If you have any information concerning the CDM Regulations, please specify below: 2. Are you interested in receiving the research results: Yes ❑No❑ (If yes, please provide your contact details in section 1.0)

END OF QUESTIONNAIRE; KINDLY PLACE THE COMPLETED QUESTIONNAIRE IN THE SELF-ADDRESSED ENVELOPE.

Thank you for your contribution.

APPENDIX – 3 (QUESTIONNNAIRE SURVEY – PRINCIPAL CONTRACTOR)

Section 1.0: Professional background information		
1. Which of the following best describes your role in the organisation? (Please tick [✓] one box only)		
Health and Safety Manager ❑	Construction Manager❑	Site Manager❑
Project Manager❑	Other ❑(If other, please specify):____	
2. How many years of experience do you have in this role? Please specify____		
3. How many years of experience do you have in the construction industry in total? Please specify________________________		
4. Contact details (Optional)		

Name:	
Address:	
Telephone:	
Email:	

Section 2.0: Appointment as Principal Contractor					
Please answer all questions by ticking [✓] in the appropriate box. *The rating scale is as follows: 5 = 'highly likely', 4 = 'likely', 3= 'even', 2 = 'unlikely' and 1= 'highly unlikely'*					
1. Based on your experience, when is the Principal Contractor likely to be appointed on the project:	*Highly likely*				*Highly unlikely*
	5	4	3	2	1
a. Preparation and brief stage					
b. Concept design stage					
c. Developed design stage					
d. Technical design stage					
e. Construction stage					
Other:					

2. To what extent is the client likely to request information on the following regarding your competence:	*Highly likely*				*Highly unlikely*
	5	4	3	2	1
a. Organisation profile and arrangements relating to health and safety					
b. Past experience based on a similar construction project					
c. Certification in construction health and safety (e.g. skills based training)					
d. Knowledge/expertise of key personnel					
e. Professional institution membership of key personnel					
f. Continuous professional development and training					
g. Individual qualifications and experience					
h. None of the above because of evidence of other standard pre-qualification					
Other:					

Section 3.0: Extent to which duties of the Principal Contractor are discharged in practice					
Please tick [✓] in the appropriate box. *The rating scale is as follows: 5 = 'always', 4 = 'often', 3= 'sometimes', 2 = 'rarely' and 1= 'never'*					
1. To what extent are the following duties of the Principal Contractor discharged in practice:	***Always***				***Never***
	5	4	3	2	1
a. Prepare the construction phase plan before construction work and pay adequate attention to information provided by the designer.					
b. Implement the construction phase so as to ensure the health and safety of all persons carrying out the construction work.					
c. Update, review and revise the construction phase plan when appropriate throughout the project.					
d. Take all reasonable steps to ensure that the construction phase plan identifies the risks to health and safety.					
e. Ensure that the construction phase is planned, managed and monitored in a reasonably practicable manner, while facilitating cooperation and coordination between contractors and pursuance of the general principles of prevention.					

Section 3.0: Extent to which duties of the Principal Contractor are discharged in practice (Continued)					
Please tick [✓] in the appropriate box. *The rating scale is as follows: 5 = 'always', 4 = 'often', 3= 'sometimes', 2 = 'rarely' and 1= 'never'*					
f. Liaise with the CDM Coordinator and designers regarding any design/or change to design during the construction phase.	5	4	3	2	1
g. Ensure provision of adequate welfare facilities throughout the construction phase.					
h. Draw up site rules where necessary for health and safety, appropriate to the construction site/activities.					
i. Offer reasonable directions to any contractor when necessary to enable compliance with his duties under the Regulations.					
j. Ensure that contractors are informed of the minimum amount of time required for preconstruction planning before actual construction work.					
k. Consult contractors where necessary before finalising the part of the construction phase plan relevant to his work.					
l. Ensure all contractors have access to the relevant part of the construction phase plan before actual construction work.					
m. Ensure contractors are given sufficient time before construction work to prepare and provide welfare facilities and carry out work without risk.					
n. Ensure each contractor promptly provides construction activity information likely to be required by the CDM Coordinator for inclusion in the health and safety file.					
o. Ensure project notification particulars are displayed in a legible manner so as to be read by any worker engaged in the construction work.					
p. Take reasonable steps so as to prevent persons unauthorised to access the site.					
q. Ensure site induction and training is provided to every worker carrying out the construction work.					
r. Facilitate cooperation with workers engaged in the construction work and developing measures to ensure health, safety or welfare of workers and checking the effectiveness of such measures					
s. Consult workers or their representatives on matters regarding the project in line with their health, safety and welfare.					
t. Ensure that workers or their representatives can inspect and take copies of any planning and management information which relates to the project.					
Other:					

Section 4.0: Extent to which duties of the Principal Contractor are burdensome in practice						
Please tick [✓] in the appropriate box. *The rating scale is as follows: 5 = 'most burdensome', 4 = 'burdensome', 3= 'even', 2 = 'somehow burdensome' and 1= 'least burdensome*						
1.	To what extent are the following duties of the Principal Contractor burdensome to discharge in terms of the administrative work or organisational effort involved which as a result generates excessive paperwork:	***Most burdensome***				***Least burdensome***
		5	4	3	2	1
a.	Prepare the construction phase plan before construction work and pay adequate attention to information provided by the designer.					
b.	Implement the construction phase so as to ensure the health and safety of all persons carrying out the construction work.					
c.	Update, review and revise the construction phase plan when appropriate throughout the project.					
d.	Take all reasonable steps to ensure that the construction phase plan identifies the risks to health and safety.					
e.	Ensure that the construction phase is planned, managed and monitored in a reasonably practicable manner, while facilitating cooperation and coordination between contractors and pursuance of the general principles of prevention.					
f.	Liaise with the CDM Coordinator and designers regarding any design/or change to design during the construction phase.					
g.	Ensure provision of adequate welfare facilities throughout the construction phase.					
h.	Draw up site rules where necessary for health and safety, appropriate to the construction site/activities.					
i.	Offer reasonable directions to any contractor when necessary to enable compliance with his duties under the Regulations.					

Section 4.0: Extent to which duties of the Principal Contractor are burdensome in practice (Continued)						
Please tick [✓] in the appropriate box. *The rating scale is as follows: 5 = 'most burdensome', 4 = 'burdensome', 3= 'even', 2 = 'somehow burdensome' and 1= 'least burdensome*						
j.	Ensure that contractors are informed of the minimum amount of time required for preconstruction planning before actual construction work.	5	4	3	2	1
k.	Consult contractors where necessary before finalising the part of the construction phase plan relevant to his work.					
l.	Ensure all contractors have access to the relevant part of the construction phase plan before actual construction work.					
m.	Ensure contractors are given sufficient time before construction work to prepare and provide welfare facilities and carry out work without risk.					
n.	Ensure each contractor promptly provides construction activity information likely to be required by the CDM Coordinator for inclusion in the health and safety file.					
o.	Ensure project notification particulars are displayed in a legible manner so as to be read by any worker engaged in the construction work.					
p.	Take reasonable steps so as to prevent persons unauthorised to access the site					
q.	Ensure site induction and training is provided to every worker carrying out the construction work.					
r.	Facilitate cooperation with workers engaged in the construction work and developing measures to ensure health, safety or welfare of workers and checking the effectiveness of such measures.					
s.	Consult workers or their representatives on matters regarding the project in line with their health, safety and welfare.					
t.	Ensure that workers or their representatives can inspect and take copies of any planning and management information, which relates to the project.					
Other:						

Section 5.0: Importance of the Principal Contractor duties						
Please tick [✓] in the appropriate box. *The rating scale is as follows: 5 = 'most important', 4 = 'important', 3= 'even', 2 = 'less important' and 1= 'least important'*						
1.	To what extent are the following duties of the Principal Contractor important in terms of actual positive impact on health and safety:	***Most important***				***Least important***
		5	4	3	2	1
a.	Prepare the construction phase plan before construction work and pay adequate attention to information provided by the designer.					
b.	Implement the construction phase to ensure the health and safety of all persons carrying out the construction work.					
c.	Update, review and revise the construction phase plan when appropriate throughout the project.t					
d.	Take all reasonable steps to ensure that the construction phase plan identifies the risks to health and safety.					
e.	Ensure that the construction phase is planned, managed and monitored in a reasonably practicable manner, while facilitating cooperation and coordination between contractors and pursuance of the general principles of prevention.					
f.	Liaise with the CDM Coordinator and designers regarding any design/or change to design during the construction phase.					
g.	Ensure provision of adequate welfare facilities throughout the construction phase.					
h.	Draw up site rules where necessary for health and safety, appropriate to the construction site/activities.					
i.	Offer reasonable directions to any contractor when necessary to enable compliance with his duties under the Regulations.					
j.	Ensure that contractors are informed of the minimum amount of time required for preconstruction planning before actual construction work.					
k.	Consult contractors where necessary before finalising the part of the construction phase plan relevant to his work.					
l.	Ensure all contractors have access to the relevant part of the construction phase plan before actual construction work.					
m.	Ensure contractors are given sufficient time before construction work to prepare and provide welfare facilities and carry out work without risk.					
n.	Ensure each contractor promptly provides construction activity information likely to be required by the CDM Coordinator for inclusion in the health and safety file.					
o.	Ensure project notification particulars are displayed in a legible manner so as to be read by any worker engaged in the construction work					
p.	Prepare the construction phase plan before construction work and pay adequate attention to information provided by the designer.					
q.	Ensure site induction and training is provided to every worker carrying out the construction work.					
r.	Facilitate cooperation with workers engaged in the construction work and developing measures to ensure health, safety or welfare of workers and checking the effectiveness of such measures.					
s.	Consult workers or their representatives on matters regarding the project in line with their health, safety and welfare.					
t.	Ensure that workers or their representatives can inspect and take copies of any planning and management information which relates to the project.					
Other:						

Section 6.0: CDM Duty holder role(s) undertaken in practice						
Tick [✓] in the appropriate box. *The rating scale is as follows: 5 = always', 4 = 'often', 3= 'sometimes', 2 = 'rarely' and 1= 'never'*						
1.	Please rate the following statements as accurately as possible based on your experience.	*Always* 5	4	3	2	*Never* 1
a.	I am usually provided with enough resources to perform my role as Principal Contractor.					
b.	I (or my organisation) take/s on the combined roles of Principal Contractor and Client.					
c.	I (or my organisation) take/s on the combined roles of Principal Contractor and CDM Coordinator.					
d.	I (or my organisation) take/s on the combined roles of Principal Contractor and Designer.					
e.	I (or my organisation) take/s on the combined roles of Principal Contractor and Main Contractor under the contract.					
f.	I (or my organisation) take/s on the combined roles of Principal Contractor and Contract Administrator.					
Other:						

Section 7.0: Resourcing of the Principal Contractor role

Tick [✓] in the appropriate box

4. Please specify the resourcing required to adequately perform the role of Principal Contractor during the preconstruction planning phase:

a.	Less than 10 man days	❑
b.	11 – 20 man days	❑
c.	21 – 30 man days	❑
d.	31 – 40 man days	❑
e.	41 – 50 man days	❑
f.	Other	❑

If other, please provide details:

5. Please specify the resourcing required to adequately perform the role of Principal Contractor during the construction phase:

a.	Less than 1 man day per week	❑
b.	2 man days per week	❑
c.	3 man days per week	❑
d.	4 man days per week	❑
E	5 man days per week	❑
f.	Other	❑

If other, please provide details:

6. Please specify the cost of a man-day of the Principal Contractor:

a.	Less than £200	❑
b.	£201 – £300	❑
c.	£301 – £400	❑
d.	£401 – £500	❑
E	£501 - £600	❑
F	More than £ 600	❑

Section 8.0 Changes to the CDM Regulations

Please comment on the following:

6. The most important change I would like to see in the CDM Regulations is:

7. The most important change I would like to see in the role of the Principal Contractor is:

8. The most important change I would like to see in the role of the CDM Coordinator is:

9. The most important change I would like to see in the CDM role of the Designer is:

10. The most important change I would like to see in the CDM role of the Client is:

Section 9.0 General information

3. If you have any information concerning the CDM Regulations, please specify below:

4. Are you interested in receiving the research results: Yes ❑No❑

(If yes, please provide your contact details in section 1.0)

END OF QUESTIONNAIRE; PLEASE PLACE THE COMPLETED QUESTIONNAIRE IN THE SELF-ADDRESSED ENVELOPE

Thank you for your contribution.

APPENDIX – 4 (INTERVIEW GUIDE/SCHEDULE – DESIGNERS)

INTERVIEW GUIDE/SCHEDULE – DESIGNER
Section 1: Background information
1. What is your current position in the organisation? 2. For how long have you performed this role? 3. How many years of experience do you have in the construction industry in total? 4. How many years of experience do you have with regards to the practical implementation of CDM Regulations? 5. What is your professional background (Architect, Engineer)? 6. Are you a member of any professional institution (e.g. APS, RIBA, and ICE)?
Section 2: Concept design stage
1. What are the practical steps taken to design out risk? 2. Which part(s) of the design do you consider as the most important when designing out risk? 3. Do you receive any input from the CDM Coordinator when designing out these risks? 4. What are the main challenges encountered during this process? 5. What measures are put in place to address these challenges?
Section 3: Developed design stage
1. What information is conveyed on the drawings to design out risk? 2. How is this information beneficial to the Principal Contractor when preparing the Construction Phase Plan? 3. What are the main challenges encountered when conveying this information to the drawings? 4. What measures are put in place to address these challenges?
Section 4: Construction phase
1. What procedures are followed by you (or your organisation) to ensure that identified risks are taken into consideration during the construction phase? 2. What are the main challenges encountered during this process? 3. What measures are put in place to address these challenges?
Section 5: Preparation of the Health and Safety File.
1. What information does your organisation provide during the preparation of the health and safety file? 2. What are the main challenges encountered during the preparation of the Health and Safety File? 3. What measures are put in place to address these challenges?
Section 6: Changes to the CDM Regulations
1. What is the most important change you would like to see in the CDM Regulations? 2. What is the most important change you would like to see in the role of Designer? 3. What is the most important change you would like to see in the role of CDM Coordinator? 4. What is the most important change you would like to see in the role of Principal Contractor?

END OF INTERVIEW

Thank you.

APPENDIX – 5 (RESEARCH REPORT)

AN INVESTIGATION INTO THE IMPLEMENTATION OF THE CONSTRUCTION (DESIGN AND MANAGEMENT) REGULATIONS

RESEARCH REPORT

By: Dingayo Mzyece (Doctoral Research Student)

"CDM Regulations, improving health and safety in your industry"

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1.0 Introduction (Research context and overview)

The Construction (Design and Management) Regulations 2007 (commonly referred to as 'CDM 2007') came into force on 6 April 2007. Since its introduction, CDM 2007 has faced criticism regarding implementation problems. Issues such as misunderstanding of duties, unnecessary generation of paperwork, and ambiguity of role(s) among others have been widespread. To understand the nature of such concerns and problems associated with implementation of the regulations, research was undertaken to critically examine their implementation in practice, identify compliance challenges and gaps, so as to develop a framework for remedial action towards a more robust and effective regulatory regime. It is also worth pointing out that this research commenced before Government plans to revise the current regulations and therefore considered useful for future reforms.

This report provides a summary of the main research findings. It describes the emerging patterns from the primary data. The aim of this report is to give respondents the opportunity to evaluate the proposed remedial actions and identified change drivers emerging from the results. The research design adopted for the study is summarised in Section 2.0 whilst discussion of the main findings is in Section 3.0. Section 4.0 outlines the implications of the findings. A summary of this report is in Section 5.0. The final section provides a framework for you to evaluate the proposed remedial actions and drivers of change from the perspective of feasibility and efficacy.

2.0 Research design

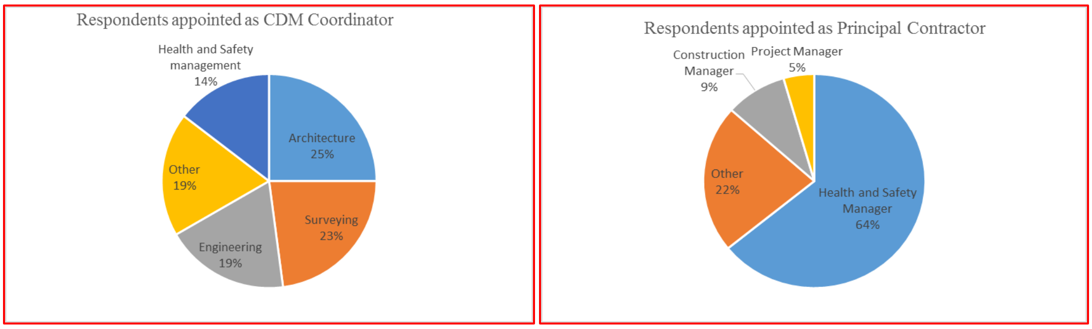
Two surveys were undertaken targeting project stakeholders appointed in the roles of Principal Contractor (PC) and CDM Coordinator (CDM-C). Out of the 774 questionnaires targeted at Principal Contractors, 74 were returned (approximately 10% response rate). Of the returned questionnaires, 67 were fully completed and therefore utilised for the purposes of this study. 226 questionnaires were targeted at CDM-Cs. 48 were returned and fully completed (approximately 21% response rate). These surveys were complimented by interviews with design experts appointed in the role of the designer.

3.0 Main findings

Professional profiles of respondents

CDM-Cs come from a wide range of professional backgrounds (Fig. 1) and are all members of one or more professional bodies. The vast majority are members of APS (69%) and IOSH (42%). On average, they had over 13 years of experience, suggesting that most had previously been Planning Supervisors under CDM 1994. Most of the participants who responded as PCs were health and safety (H&S) managers of their organisations. On average, they also had over 13 years of experience. As for the designers interviewed, they had an average of 33 years' experience.

These respondent profiles suggest that the research participants are vastly experienced in H&S matters and have full experience of both CDM 1994 and 2007 and as such, their views can be considered reliable.



Figures 1: Professional background of respondents

Appointment stage and resourcing requirements
The results show that it was commonplace for the CDM-C to be appointed during the technical design stage, which reduces their input towards early risk identification, improved coordination, and integrated H&S planning. This is surprising considering the widely acknowledged importance of early appointment. It may be attributable in part to the failure of the current CDM 2007 (and ACoP) to definitively specify when appointments must be made. The PC was largely appointed during the construction stage. This is perhaps symptomatic of the pervasive traditional approaches to procurement in the construction industry. Arguably, as the industry gravitates more towards integrated project delivery (IPD), early appointment of the PC is more likely to be the norm.

At least 32% felt that resourcing for the CDM-C role was generally inadequate. Combined with late appointments of CDM-Cs, this shows a systemic failure that ultimately leads to poor discharge of CDM-C duties. The number of man-days required for the discharge of CDM-C duties was typically less than 10 man-days for the entire pre-construction phase and less than 1 man-day per week during construction at a cost of £301-£400 per man-day. For PCs, the equivalent requirement was typically 11-20 man-days at pre-construction and 5 man-days per week at a cost of £201-£300 per man-day. Again, at least 36% considered resourcing for the PC role to be generally inadequate.

Though not the norm, there is evidence that some respondents take on dual roles. For CDM-Cs, the most common combination is with the contract administrator or designer role. PCs on the other hand commonly tend to be the main contractor. In some instances, PCs are also designated as designers.

Extent of discharge of duties, and their perceived degree of importance and difficulty
Tables 1 and 2 summarise the most/least important duties, most/least difficult, and most/least frequently discharged duties. The results generally reveal significant inconsistencies in the implementation of the CDM Regulations considering the perceived degree of importance of duties to H&S, and the perceived degree of difficulty to discharge the duties.

Table 1: Rating of duties of the CDM Coordinator

Description of duties of the CDM Coordinator	**Important**		**Difficult**		**Discharged**	
Rating	*Most*	*Least*	*Most*	*Least*	*Most*	*Least*
Ensuring notice is given to the HSE (Reg. 21(1))		✓		✓	✓	
Giving suitable advice to the client (Reg. 20(1)(a))				✓		
Ensuring arrangements for coordination of H&S measures (Reg. 20(1)(b))	✓			✓		✓
Liaising with the PC (Reg. 20(1)(c))			✓		✓	
Taking reasonable steps towards identifying and collecting preconstruction information (Reg. 20(2)(a))	✓					
Promptly providing preconstruction information (Reg. 20(2)(b))	✓					
Taking reasonable steps to ensure designers comply with their duties (Reg. 20(2)(c))			✓			✓
Taking reasonable steps during the construction phase to ensure cooperation between designers and PC (Reg. 20(2)(d))		✓				✓
Preparing the H&S file (Reg. 20(2)(e))			✓			
Handing over the H&S File (Reg. 20(2)(f))		✓			✓	

Table 2: Rating of duties of the Principal Contractor

Description of duties of the Principal Contractor	**Important**		**Difficult**		**Discharged**	
Rating	*Most*	*Least*	*Most*	*Least*	*Most*	*Least*
Ensuring the construction phase is planned, managed, and monitored in a reasonably practicable manner (Reg. 22(1)(a))	✓					
Liaising with the CDM-C and designers regarding any design/or change to design during the		✓	✓			

Description of duties of the Principal Contractor	**Important**		**Difficult**		**Discharged**	
Rating	*Most*	*Least*	*Most*	*Least*	*Most*	*Least*
construction phase (Reg. 22(1)(b))						
Ensuring provision of adequate welfare facilities throughout the construction phase (Reg. 22(1)(c))				✓	✓	
Drawing up site rules for H&S, appropriate to the construction site/activities (Reg. 22(1)(d))				✓	✓	
Ensuring contractors are informed of the minimum amount of time required for preconstruction planning before actual construction work (Reg. 22(1)(f))						✓
Consulting contractors before finalising the part of the construction phase plan relevant to their work (Reg. 22(1)(g))			✓			✓
Ensuring each contractor promptly provides construction activity information required in the H&S File (Reg. 22(1)(j))			✓			
Ensuring project notification particulars are displayed in a legible manner (Reg. 22(1)(k))		✓		✓		
Ensuring site induction and training is provided to every worker carrying out the construction work (Reg. 22(2))	✓					
Implementing the construction phase plan (Reg. 23(1)(c))	✓				✓	
Ensuring workers or their representatives can inspect and take copies of any planning and management information (Reg. 24(c))		✓				✓

A critical analysis of the data reveals various patterns, some of which are surprising. For example, ensuring arrangements for coordination of H&S measures during planning and preparation of the construction phase (Reg. 20(1)(b)) was perceived most important and least difficult to discharge, yet least discharged. Handing over the H&S File (Reg. 20(2)(f)) and ensuring notice is given to the HSE (Reg. 21(1)) were perceived as least important and yet most frequently discharged.

As for duties of the PC, liaising with the CDM-C and designers (Reg. 22(1)(b)) was perceived least important and most difficult by respondents representing the PC. This duty is thus clearly a candidate for review. In addition, despite perceiving implementation of the Construction Phase Plan (Reg. 23(1)(c)) as most important and discharged regularly, discharging the complementary duty to consult contractors before finalising the part of the Construction Phase Plan relevant to their work (Reg. 22(1)(g)) was perceived as one of the most difficult and least discharged. This calls into question the quality of the Construction Phase Plan that the PC is actually implementing.

Overall, the following observation may be drawn from the analysis of the data.

(a) The CDM 2007 duties are perceived to varying degrees of importance in terms of contribution to improved H&S performance outcomes. In particular, ensuring notice is given to the HSE (Reg. 21(1)) and ensuring workers or their representatives can inspect and take copies of any planning and management information (Reg. 24(c)) were not considered as important as other CDM-C and PC duties.

(b) There is some variation in the extent of discharge of CDM 2007 duties across the industry, attributable in part to factors such as timing of appointments and resource adequacy.

(c) There is also some variation in the extent to which individual CDM-Cs and PCs discharge all the duties imposed on them by CDM 2007. This variation may also be attributable in part to factors such as timing of appointments and resource adequacy.

(d) Failure to discharge all duties fully suggests a lack of accountability or policing of the regulations.

(e) There is little correlation between the extent of discharge of duties by duty holders and, perceived degree of importance of the duty in terms of contribution to improved H&S performance outcomes. This may signal a lack of understanding of the importance of certain duties. Considering the need to prioritise deployment of limited resources e.g. time, money and effort, the lack of distinction between critical and less important duties could have implications for optimal H&S performance.

(f) There is little correlation between the extent of discharge of duties by duty holders and, perceived degree of difficulty of the task. This suggests that the issue of difficulty should not be of prime concern when considering reforms.

(g) Difficulties largely relate to dealing with other duty holders, symptomatic of an industry where cooperation and collaboration continues to be a challenge. An example of such a difficulty can be seen in the duty to ensure designers comply with their duties (Reg. 20(2)(c)) which was perceived as most difficult and least discharged.

(h) An independently appointed CDM-C does not provide sufficient input during the (pre)construction phase. This was the consensus view of interviewees, and may be a symptom of the lack of collaboration that ails the construction industry. It was unsurprising therefore that there were recommendations for the replacement of the CDM-C among interviewees in future reforms.

(i) The misalignment of duties owing to their extent of discharge, and the perceived degree of importance and difficulty questions their impact on improved H&S performance outcomes.

4.0 Implications of findings and remedial actions

It is clear from the results that there is need for improved collaboration and accountability throughout the construction project. It is also evident, that the main contractor is best placed to discharge coordination duties. Besides the late appointment of the PC, the results also show that various types of documentation are requested as evidence of their competence, which was reported to generate excessive paperwork. In order to facilitate CDM implementation improvement, there is need for industry to seriously consider undertaking corrective steps. Having analysed the empirical evidence and consistency of the CDM 2007 with the TMCS Directive, 13 remedial actions and 8 overarching drivers are proposed towards addressing implementation challenges and achieving optimum performance of the CDM Regulations. These are summarised below in Table 3 under the three recurring themes of: (i) collaboration; (ii) accountability and compliance; and (iii) facilitation.

Table 3: Proposed remedial actions and drivers

Theme(s)	Remedial action(s)	Corresponding driver(s)
(i) Collaboration	• Include provisions for specific appointment stage of duty holders • Proactive collaboration and early duty holder involvement by applying collaborative procurement tools such as Building Information Modelling (BIM) • Ensure adequate arrangements for coordination of H&S measures during planning and preparation for the construction phase • Include provisions for domestic clients	• Management leadership • Equip duty holders with appropriate BIM competence • Provide adequate resourcing throughout the (pre)construction phase
(ii) Accountability and compliance	• The main contractor to replace the CDM-C duty holder and discharge coordination duties • Provide proportionate resourcing to reflect specific risk assessment and competence requirements • Include a complete as-implemented Construction Phase Plan in the H&S File • Industry/academic bespoke training and curriculum development to trigger and encourage optimal discharge of duties	• Industry/academic driven training to equip the main contractor with sufficient knowledge on discharging coordination duties • Proactive participation of duty holders in developing the H&S File
(iii) Facilitation	• Wider dissemination/sensitization of breaches, offences and prosecutions • Amend the ACoP to provide guidance on early decisions involvement • Amend the ACoP to provide guidance on	• Equip duty holders with sufficient knowledge on the consequences of breaches/prosecutions and subsequent penalties (e.g. fines

Theme(s)	Remedial action(s)	Corresponding driver(s)
	sufficient provision of preconstruction information • Amend the ACoP to provide guidance on specific appointment stage decision • Amend the ACoP to provide guidance on determining what resources are adequate for a particular project.	and imprisonment) through training and provisions within standard form contracts • Industry/academic training to equip duty holders with sufficient knowledge on the benefits of early decision making involvement • Industry/academic training to equip duty holders with sufficient knowledge on provision of timely and adequate preconstruction information

5.0 Conclusion

The results reveal that there is variation in CDM implementation expectations and outcomes. Such variation manifests itself in differences in the effort and persistence that goes into discharge of duties. This research therefore demonstrates that there is still considerable scope for reform and improvement because of under-implementation. Further, there are some inferences from this study that corroborate findings from the recent industry consultation/proposed changes regarding the CDM 2007, while others diverge such as placing coordination responsibilities on the main contractor rather than the Principal Designer, given that the industry is gravitating towards collaborative procurement initiatives.

The study further makes recommendations for inclusion of a specific appointment stage for duty holders, proactive collaboration and early duty holder involvement by applying collaborative procurement tools such as Building Information Modelling (BIM), encouraging industry/academic driven bespoke training and academic curriculum development among others to improve H&S competence issues and CDM implementation, thus achieving optimum H&S performance. These recommendations are consistent with the TMCS Directive and it is anticipated that performing such remedial actions will trigger improved CDM implementation and H&S performance outcomes. However, there is need for further research to determine the precise adequacy of resourcing regarding the discharge of CDM duties.

6.0 An evaluation of the remedial actions and drivers

6.1 - Remedial actions: Please evaluate the remedial actions in terms of the likelihood to improve CDM implementation (i.e. '5' = *high likely*, '4' = *likely*, '3' = *uncertain*, '2' = *unlikely* and '1' = *highly unlikely*). Simply tick ☑ or click in box to insert your answer.

Item	The proper discharge or implementation of this duty/action is likely to trigger improved CDM outcomes	5	4	3	2	1
(a)	Include provisions for specific appointment stage of duty holders	5☐	4☐	3☐	2☐	1☐
(b)	Proactive collaboration and early duty holder involvement by applying collaborative procurement tools such as Building Information Modelling (BIM)	5☐	4☐	3☐	2☐	1☐
(c)	Ensure adequate arrangements for coordination of H&S measures during planning and preparation for the construction phase	5☐	4☐	3☐	2☐	1☐
(d)	Include provisions for domestic clients	5☐	4☐	3☐	2☐	1☐
(e)	The main contractor to replace the CDM-C duty holder and discharge coordination duties	5☐	4☐	3☐	2☐	1☐
(f)	Provide proportionate resourcing to reflect specific risk assessment and competence requirement(s)	5☐	4☐	3☐	2☐	1☐
(g)	Include a complete as-implemented Construction Phase Plan in the H&S File	5☐	4☐	3☐	2☐	1☐
(h)	Industry/academic bespoke training and curriculum development to trigger and encourage optimal discharge of duties	5☐	4☐	3☐	2☐	1☐

Item	The proper discharge or implementation of this duty/action is likely to trigger improved CDM outcomes	5	4	3	2	1
(i)	Wider dissemination/sensitization of breaches, offences and prosecutions	5☐	4☐	3☐	2☐	1☐
(j)	Amend the ACoP to provide guidance on early decisions involvement	5☐	4☐	3☐	2☐	1☐
(k)	Amend the ACoP to provide guidance on sufficient provision of preconstruction information	5☐	4☐	3☐	2☐	1☐
(l)	Amend the ACoP to provide guidance on specific appointment stage decision	5☐	4☐	3☐	2☐	1☐
(m)	Amend the ACoP to provide guidance on determining what resources are adequate for a particular project	5☐	4☐	3☐	2☐	1☐
Comment: Click here to enter text.						

6.2 - Drivers to achieve remedial actions: Please evaluate the drivers for the remedial actions in terms of practicality and cost to implement/discharge in your firm (i.e. '5' = *highly feasible*, '4' = *feasible*, '3' = *uncertain*, '2' = *unfeasible* and '1' = *highly unfeasible*). Simply tick ☑ or click in box to insert your answer.

Item	The recommended driver is commercially and practically feasible	5	4	3	2	1
(a)	Management leadership	5☐	4☐	3☐	2☐	1☐
(b)	Equip duty holders with appropriate BIM competence	5☐	4☐	3☐	2☐	1☐
(c)	Provide adequate resourcing throughout the (pre)construction phase	5☐	4☐	3☐	2☐	1☐
(d)	Industry/academic driven training to equip the main contractor with sufficient knowledge on discharging coordination duties	5☐	4☐	3☐	2☐	1☐
(e)	Proactive participation of duty holders in developing the H&S File	5☐	4☐	3☐	2☐	1☐
(f)	Equip duty holders with sufficient knowledge on the consequences of breaches/prosecutions and subsequent penalties (e.g. fines and imprisonment) through training and provisions within standard form contracts	5☐	4☐	3☐	2☐	1☐
(g)	Industry/academic driven training to equip duty holders with sufficient knowledge on the benefits of early decision making involvement	5☐	4☐	3☐	2☐	1☐
(h)	Industry/academic driven training to equip duty holders with sufficient knowledge on provision of timely and adequate preconstruction information	5☐	4☐	3☐	2☐	1☐
Comment: Click here to enter text.						

Thank you for your participation. Please **save and return by email** the completed evaluation as an attachment to D.Mzyece@wlv.ac.uk. For more information about the research results, contact 07914114995.

APPENDIX – 6 (TEST OF NORMALITY – PC DUTIES)

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
prepare construction phase plan(dis_a)	.385	67	.000	.620	67	.000
implement the construction phase plan (dis_b)	.452	67	.000	.524	67	.000
update/review construction phase plan (dis_c)	.216	67	.000	.844	67	.000
ensure construction phase plan identifies risks (dis_d)	.334	67	.000	.739	67	.000
ensure construction phase is planned and monitored (dis_e)	.327	67	.000	.743	67	.000
liaise w ith CDMC and Designer (dis_f)	.274	67	.000	.861	67	.000
ensure provision of adequate w elfare facilities (dis_g)	.469	67	.000	.543	67	.000
draw up site rules (dis_h)	.476	67	.000	.525	67	.000
offer reasonable direction to every contractor (dis_i)	.319	67	.000	.749	67	.000
ensure contractors are informed of allocated time (dis_j)	.209	67	.000	.878	67	.000
consult contractors (dis_k)	.204	66	.000	.877	66	.000
ensure contractors have access to construction phase plan (dis_l)	.203	67	.000	.861	67	.000
ensure contractors are given sufficient time before construction phase (dis_m)	.219	67	.000	.870	67	.000
ensure contractor promptly provides preconstruction information (dis_n)	.200	67	.000	.847	67	.000
display of project notification (dis_o)	.426	67	.000	.578	67	.000
Prevent unauthorised persons (dis_p)	.374	67	.000	.629	67	.000
ensure site induction and training (dis_p)	.445	67	.000	.592	67	.000
facilitate cooperation (dis_r)	.257	67	.000	.805	67	.000
Consult w orkers (dis_s)	.195	67	.000	.862	67	.000
w orkers inspect copies of planning information (dis_t)	.196	67	.000	.909	67	.000
prepare construction phase plan (dif_a)	.223	66	.000	.903	66	.000
implement construction phase plan (dif_b)	.182	66	.000	.885	66	.000
update construction phase plan (dif_c)	.183	66	.000	.909	66	.000
ensure cpp identifies risks to H&S (dif_d)	.193	66	.000	.894	66	.000
ensure construction phase is planned (dif_e)	.206	66	.000	.906	66	.000
liaise w ith the CDM Coordinator (dif_f)	.217	65	.000	.909	65	.000
ensure provision of adequate w elfare facilities (dif_g)	.299	66	.000	.790	66	.000
draw up site rules (dif_h)	.326	66	.000	.760	66	.000
offer reasonable directions to contractor (dif_i)	.210	65	.000	.865	65	.000
ensure contractors are informed (dif_j)	.226	66	.000	.877	66	.000
consult contractors (dif_k)	.188	66	.000	.907	66	.000
ensure contractors have access to relevant parts of the cpp (dif_l)	.194	66	.000	.898	66	.000
ensure contractors are given sufficient time (dif_m)	.176	66	.000	.905	66	.000
ensure contractors promptly provide construction activity information (dif_n)	.218	66	.000	.891	66	.000
ensure project notification (dif_o)	.285	66	.000	.771	66	.000
take steps to prevent unauthorised persons access to the site (dif_p)	.240	66	.000	.828	66	.000

Tests of Normality

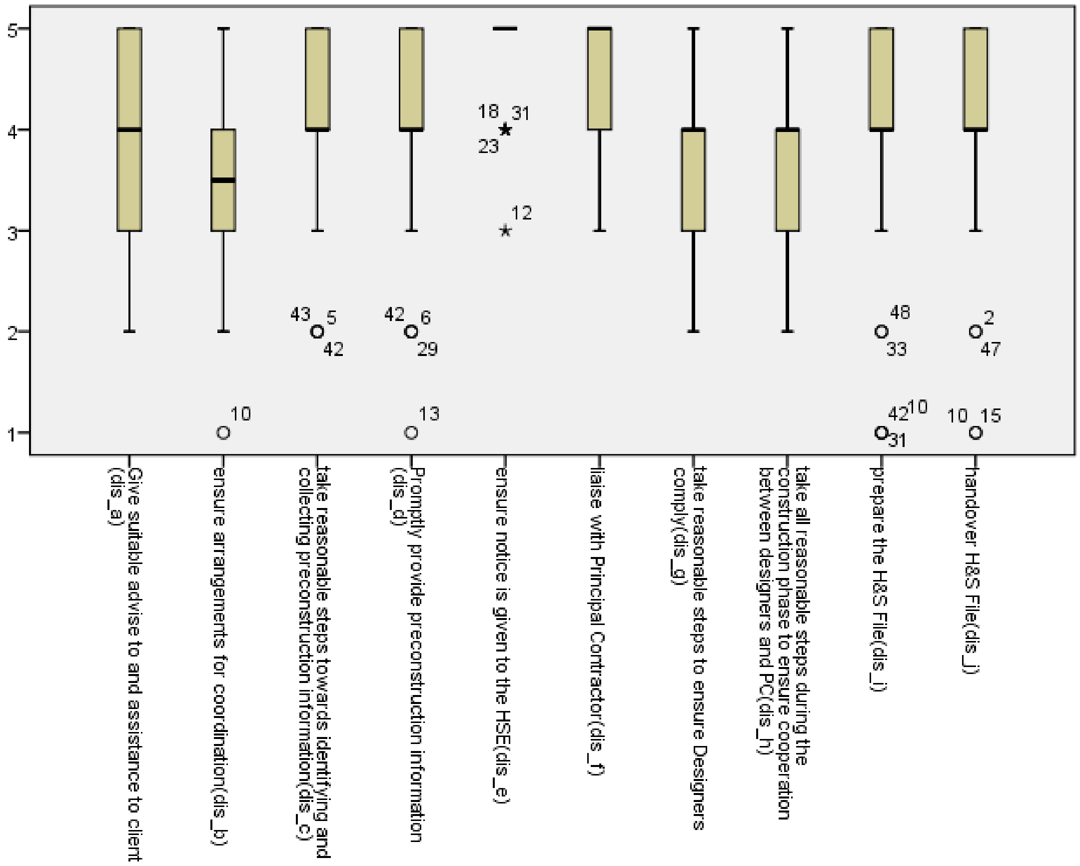
	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
ensure site induction and training (dif_q)	.210	66	.000	.870	66	.000
facilitate cooperation with workers (dif_r)	.184	66	.000	.859	66	.000
Consult workers or their representatives (dif_s))	.190	66	.000	.896	66	.000
ensure workers or their representatives can inspect planning information (dif_t)	.180	65	.000	.900	65	.000
prepare construction phase plan (imp_a)	.374	67	.000	.667	67	.000
implement construction phase plan (imp_b)	.442	67	.000	.533	67	.000
update construction phase plan (imp_c)	.226	67	.000	.838	67	.000
ensure cpp identifies risks to H&S (imp_d)	.397	66	.000	.632	66	.000
ensure construction phase is planned (imp_e)	.405	67	.000	.589	67	.000
liaise with the CDM Coordinator (imp_f)	.241	67	.000	.876	67	.000
ensure provision of adequate welfare facilities (imp_g)	.403	67	.000	.621	67	.000
draw up site rules (imp_h)	.350	66	.000	.686	66	.000
offer reasonable directions to contractor (imp_i)	.287	67	.000	.763	67	.000
ensure contractors are informed (imp_j)	.219	67	.000	.846	67	.000
consult contractors(imp_k)	.227	67	.000	.860	67	.000
ensure contractors have access to relevant parts of the cpp (imp_l)	.229	67	.000	.838	67	.000
ensure contractors are given sufficient time (imp_m)	.228	66	.000	.826	66	.000
ensure contractors promptly provide construction activity information (imp_n)	.240	67	.000	.838	67	.000
ensure project notification (imp_o)	.256	66	.000	.842	66	.000
take steps to prevent unauthorised persons access to the site (imp_p)	.332	67	.000	.695	67	.000
ensure site induction and training (imp_q)	.435	67	.000	.581	67	.000
facilitate cooperation with workers (imp_r)	.295	67	.000	.781	67	.000
consult workers or their representatives (imp_s)	.253	67	.000	.801	67	.000
ensure workers or their representatives can inspect planning information (imp_t)	.182	67	.000	.892	67	.000

a. Lilliefors Significance Correction

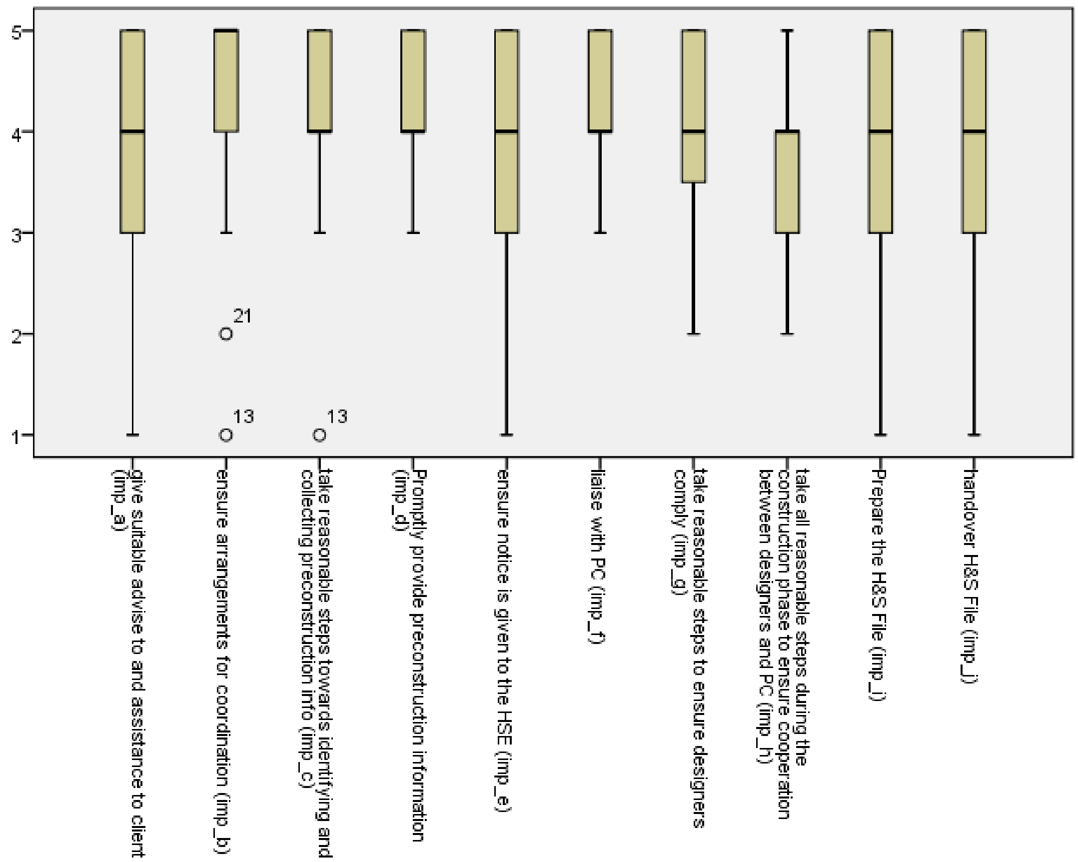
Description of Variables	Cronbach's alpha (reliability of scale)	Kendall's W coefficient of concordance (rate of agreement)
CDM-C extent of discharge	.814	.246
CDM-C degree of difficulty	.760	.316
CDM-C degree of importance	.799	.076
PC extent of discharge	.897	.331
PC degree of difficulty	.935	.234
PC degree of importance	.934	.212

APPENDIX – 7 (BOX PLOTS)

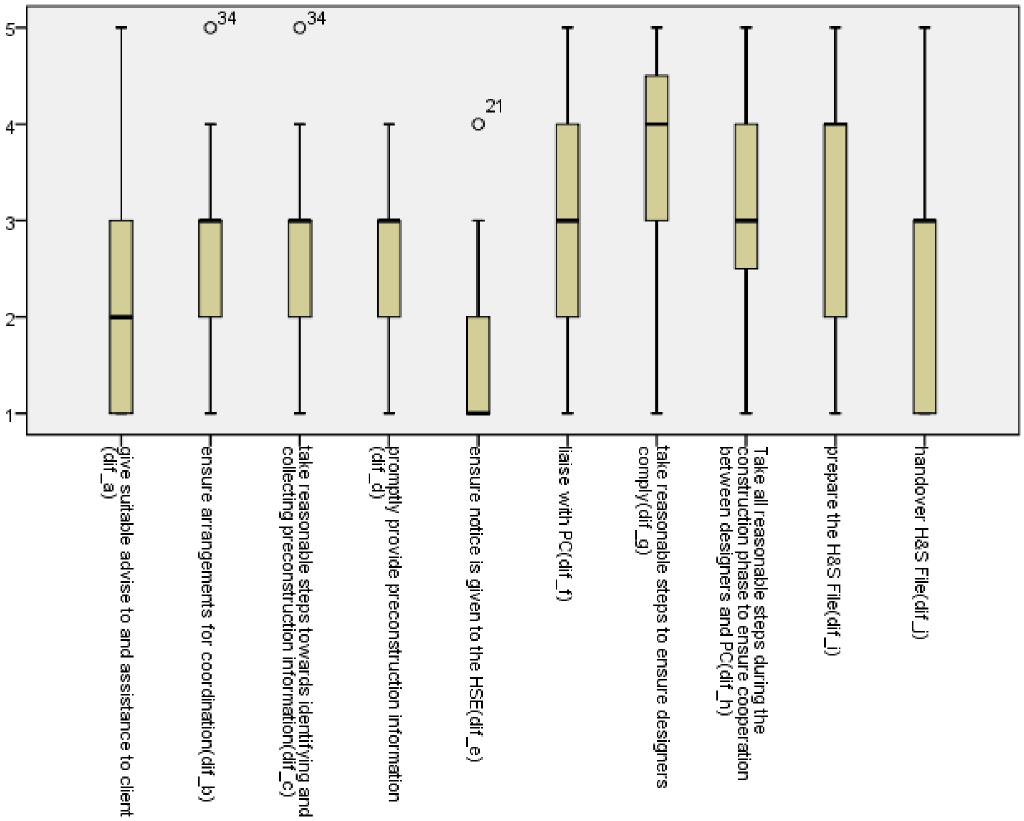
(a) CDM Coordinator – extent of discharge of duties (dependent variable)



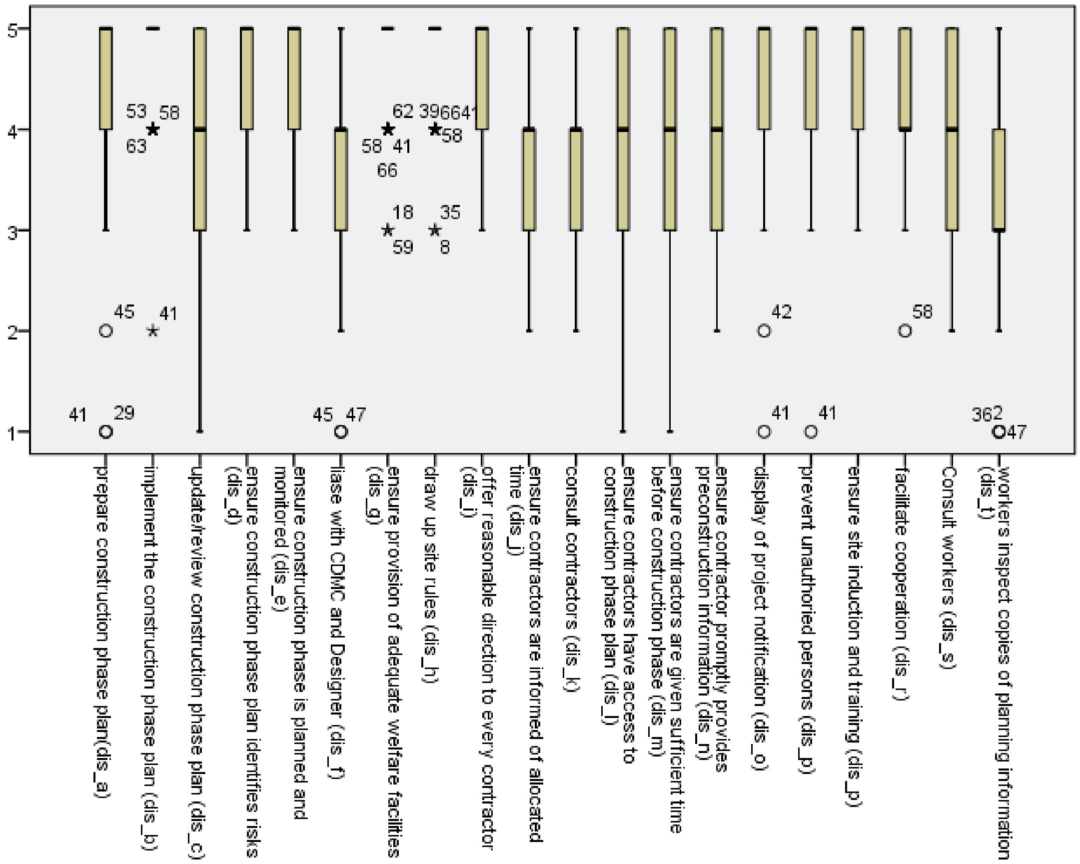
(b) CDM Coordinator – perceived degree of importance (independent variable)



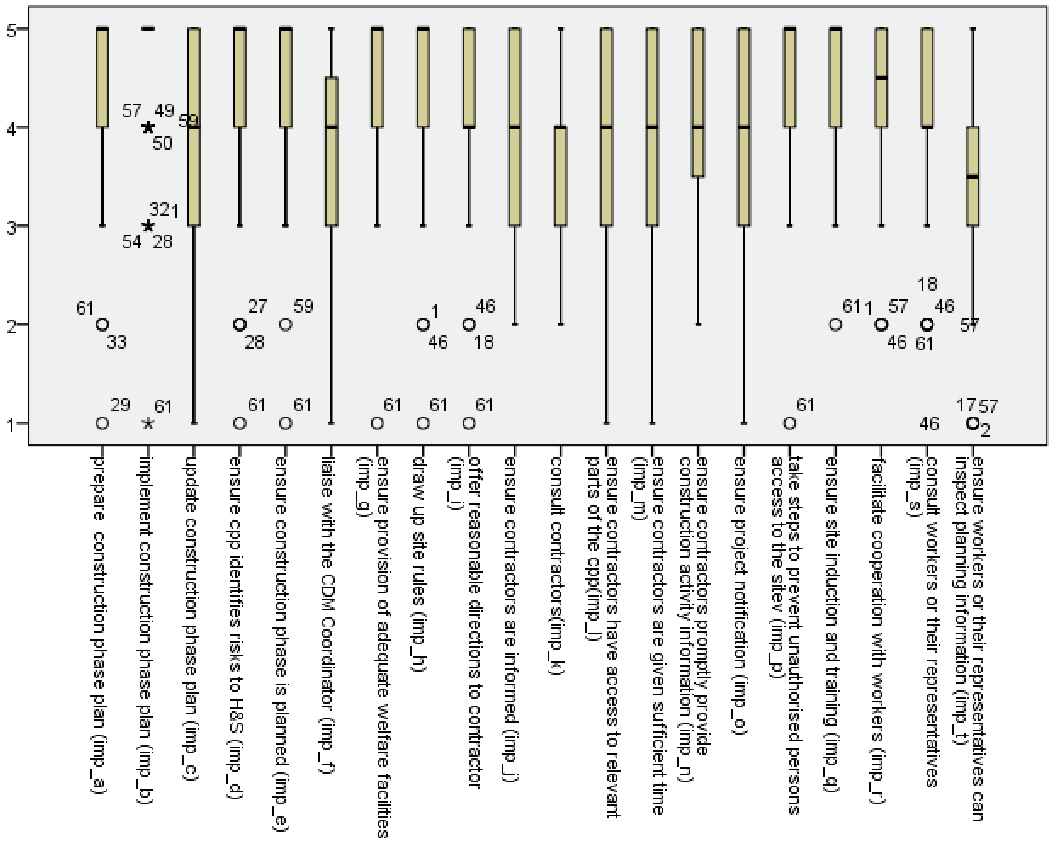
(c) CDM Coordinator – perceived degree of difficulty (independent variable)



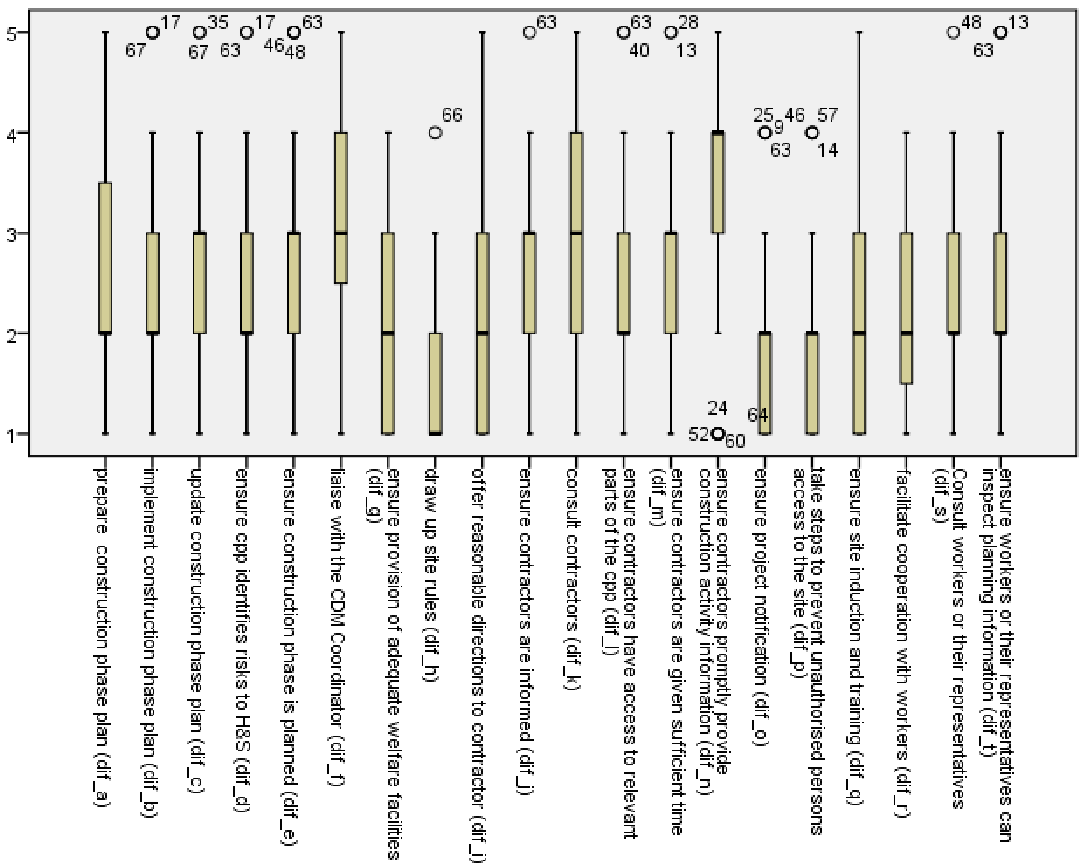
(d) Principal Contractor – extent of discharge of duties (dependent variable)



(e) Principal Contractor – perceived degree of importance (independent variable)



(f) Principal Contractor – perceived degree of difficulty (independent variable)



APPENDIX – 8 (VALIDATION OF REMEDIAL ACTION FRAMEWORK)

1. The proper discharge or implementation of this duty/action is likely to trigger improved CDM outcomes

	5 - highly likely	4 - likely	3 - uncertain	2 - unlikely	1 - highly unlikely	Number of Respondents
(a) Include provisions for specific appointment stage of duty holders	26.7% (4)	60% (9)	13.3% (2)	0% (0)	0% (0)	15
(b) Proactive collaboration and early duty holder involvement by applying collaborative procurement tools such as Building Information Modelling (BIM)	26.7% (4)	46.7% (7)	26.7% (4)	0% (0)	0% (0)	15
(c) Ensure adequate arrangements for coordination of H&S measures during planning and preparation for the construction phase	26.7% (4)	66.7% (10)	6.7% (1)	0% (0)	0% (0)	15
(d) Include provisions for domestic clients	0% (0)	26.7% (4)	40% (6)	20% (3)	13.3% (2)	15
(e) The main contractor to replace the CDM-C duty holder and discharge coordination duties	0% (0)	40% (6)	26.7% (4)	13.3% (2)	20% (3)	15
(f) Provide proportionate resourcing to reflect specific risk assessment and competence requirement(s)	20% (3)	60% (9)	20% (3)	0% (0)	0% (0)	15
(g) Include a complete as-implemented Construction Phase Plan in the H&S File	13.3% (2)	13.3% (2)	46.7% (7)	6.7% (1)	20% (3)	15
(h) Industry/academic bespoke training and curriculum development to trigger and encourage optimal discharge of duties	33.3% (5)	40% (6)	20% (3)	0% (0)	6.7% (1)	15
(i) Wider dissemination/sensitization of breaches, offences and prosecutions	13.3% (2)	53.3% (8)	26.7% (4)	6.7% (1)	0% (0)	15
(j) Amend the ACoP to provide guidance on early decisions involvement	13.3% (2)	73.3% (11)	13.3% (2)	0% (0)	0% (0)	15
(k) Amend the ACoP to provide guidance on sufficient provision of pre-construction information	20% (3)	60% (9)	20% (3)	0% (0)	0% (0)	15
(l) Amend the ACoP to provide guidance on specific appointment stage decision	26.7% (4)	46.7% (7)	26.7% (4)	0% (0)	0% (0)	15
(m) Amend the ACoP to provide guidance on determining what resources are adequate for a particular project	33.3% (5)	46.7% (7)	20% (3)	0% (0)	0% (0)	15
					Number of Respondents	***15***
					Number of respondents who skipped this question	***0***

2. The recommended driver is commercially and practically feasible to implement/discharge in your firm

		5 - highly feasible	4 - feasible	3 - uncertain	2 - unfeasible	1 - highly unfeasible	Number of Respondents
(a)	Management leadership	33.3% (5)	60% (9)	6.7% (1)	0% (0)	0% (0)	15
(b)	Equip duty holders with appropriate BIM competence	6.7% (1)	33.3% (5)	33.3% (5)	26.7% (4)	0% (0)	15
(c)	Provide adequate resourcing throughout the (pre)construction phase	20% (3)	60% (9)	20% (3)	0% (0)	0% (0)	15
(d)	Industry/academic driven training to equip the main contractor with sufficient knowledge on discharging coordination duties	6.7% (1)	60% (9)	26.7% (4)	6.7% (1)	0% (0)	15
(e)	Proactive participation of duty holders in developing the H&S File	26.7% (4)	60% (9)	13.3% (2)	0% (0)	0% (0)	15
(f)	Equip duty holders with sufficient knowledge on the consequences of breaches/prosecutions and subsequent penalties (e.g. fines and imprisonment) through training and provisions within standard form contracts	33.3% (5)	40% (6)	26.7% (4)	0% (0)	0% (0)	15
(g)	Industry/Academic driven training to equip duty holders with sufficient knowledge on the benefits of early decision making involvement	26.7% (4)	60% (9)	13.3% (2)	0% (0)	0% (0)	15
(h)	Industry/Academic driven training to equip duty holders with sufficient knowledge on provision of timely and adequate pre-construction information	26.7% (4)	53.3% (8)	20% (3)	0% (0)	0% (0)	15
						Number of Respondents	***15***
						Number of respondents who skipped this question	***0***

APPENDIX – 9 (CORRELATION MATRIX: REMEDIAL ACTIONS AND CHANGE DRIVERS)

Kendall's tau_test		CD3	CD1	CD4	CD5	CD2	CD8	CD6	CD7
RA6	Correlation Coefficient	.463	.171	-.144	.176	.145	.251	.435	.277
	Sig. (2-tailed)	.064	.472	.558	.473	.556	.301	.078	.257
	N	15	15	15	15	15	15	15	15
RA1	Correlation Coefficient	.107	-.252	-.267	-.193	***-.539****	.055	***.554****	.386
	Sig. (2-tailed)	.663	.284	.270	.424	.027	.819	.023	.109
	N	15	15	15	15	15	15	15	15
RA2	Correlation Coefficient	***.886*****	.168	-.154	.257	.363	***.569****	.104	.314
	Sig. (2-tailed)	.000	.486	.536	.301	.147	.021	.679	.206
	N	15	15	15	15	15	15	15	15
RA7	Correlation Coefficient	-.146	.415	.169	.296	.213	.052	.199	-.136
	Sig. (2-tailed)	.545	.070	.474	.209	.369	.824	.401	.564
	N	15	15	15	15	15	15	15	15
RA8	Correlation Coefficient	.262	.390	0.000	.338	.043	.169	.383	.149
	Sig. (2-tailed)	.275	.089	1.000	.151	.857	.469	.106	.525
	N	15	15	15	15	15	15	15	15
RA3	Correlation Coefficient	.312	-.425	0.000	0.000	0.000	.249	.320	***.581****
	Sig. (2-tailed)	.211	.073	1.000	1.000	1.000	.303	.193	.017
	N	15	15	15	15	15	15	15	15
RA4	Correlation Coefficient	.366	.430	.043	.425	.214	.432	.400	.082
	Sig. (2-tailed)	.125	.059	.856	.069	.363	.063	.090	.726
	N	15	15	15	15	15	15	15	15
RA5	Correlation Coefficient	-.030	.038	-.014	.057	-.232	.172	.376	.111
	Sig. (2-tailed)	.903	.868	.952	.809	.333	.464	.116	.641
	N	15	15	15	15	15	15	15	15
RA9	Correlation Coefficient	.062	.229	.376	-.151	.182	.208	.425	.348
	Sig. (2-tailed)	.800	.328	.118	.531	.451	.381	.079	.147
	N	15	15	15	15	15	15	15	15
RA10	Correlation Coefficient	.451	.130	0.000	.364	.403	.319	.385	.350
	Sig. (2-tailed)	.074	.589	1.000	.141	.105	.193	.122	.156
	N	15	15	15	15	15	15	15	15
RA11	Correlation Coefficient	.049	.283	.317	.063	***.656*****	.264	.144	.275
	Sig. (2-tailed)	.843	.232	.194	.795	.008	.275	.558	.259
	N	15	15	15	15	15	15	15	15
RA12	Correlation Coefficient	.430	-.080	-.267	.252	.015	.329	***.703*****	***.629*****
	Sig. (2-tailed)	.082	.735	.270	.296	.951	.169	.004	.009
	N	15	15	15	15	15	15	15	15
RA13	Correlation Coefficient	.247	-.093	.120	.075	-.015	.331	***.528****	***.489****
	Sig. (2-tailed)	.318	.692	.622	.758	.951	.167	.031	.043
	N	15	15	15	15	15	15	15	15

(*significant at the 0.05 level, **significant at the 0.01 level, green: positive correlation, red: negative correlation)

APPENDIX-10 (LIST OF PUBLICATIONS)

Mzyece, D., Ndekugri, I., Ankrah, I. and Hammond, F. (2012a) The Principal Contractor's role under the Construction (Design and Management) Regulations 2007: Areas for further research based on a qualitative inquiry, *In* Smith S. (ed.) *Proceedings of the 28th Annual ARCOM conference*, Edinburgh, UK, Association of Researchers in Construction Management (ARCOM), pp. 465–474.

Mzyece, D., Ndekugri, I., Ankrah, N. and Hammond, F. (2012b) Contractual provisions for health and safety: Standard form contracts in the UK construction industry, *In* Ofori, G., Krisiani, T., and Teo, E. A. L. (eds.) *CIB W099 International Conference: Modeling and Building Safety*, Singapore, National University of Singapore.